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POLLUTION OF THE INTERSTATE WATERS OF THE MONONGAHELA RIVER SYSTEM

A. D. Sidio, et al

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

December 1963

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REPORT ON POLLUTION
OF THE
INTERSTATE WATERS
OF THE
MONONGAHELA RIVER SYSTEM

by

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U. S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
ROBERT A. TAFT SANITARY ENGINEERING CENTER

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CINCINNATI, OHIO

DECEMBER 1963

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The West Virginia Division of Water Resources provided information on uses and sources of water pollution in the West Virginia section of the basin.

The State of Maryland provided field reports, along with other information and data relating to the condition of Monongahela tributaries in Maryland.

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SUMMARY AND CONCLUSIONS

During the months of August and September, 1963, a study was made of the Monongahela River System. The study included analyses and observations of chemical, biological, bacteriological, and physical indicators of water quality.

Data collected during the 1963 study, along with other reports, information and data were used to prepare this report on the existing conditions of the Monongahela River and its tributaries to the Allegheny County, Pennsylvania, line.

The drainage area of the Monongahela Basin includes sections of three states: West Virginia, Maryland, and Pennsylvania. In addition to the Monongahela main stem, seven interstate tributaries are considered in the report.

WATER USES

The main stem of the Monongahela is canalized for navigation over its entire length of 129 miles.

All major public and industrial water supplies in the basin are drawn from surface sources, with the Monongahela serving as the major source. The main streams of the Monongahela serve as sources of water supply to a population of over 388,000 in the reaches considered. A total population of over 700,000 depends on the Monongahela and its tributaries as sources of domestic water supply. Industrial uses of the Monongahela surface waters exceed 6,000 million gallons per day (mgd) including 4,000 mgd for cooling water.

The Monongahela is presently used to a limited extent for recreation, including boating, bathing, and water skiing. Reservoirs on the tributary streams provide an inviting environment for water contact recreational activities. Fishing is limited to those reaches and tributaries not adversely affected by excessive acid mine drainage.

Four reservoirs are located on the tributaries to the Monongahela. Two of these, Lake Lynn on the Cheat River and Deep Creek Reservoir on Deep Creek, a tributary to the Youghiogheny, are used to produce peak load power. Two others, the Tygart Reservoir on the Tygart River and the Youghiogheny Reservoir on the Youghiogheny, are operated for low flow control.

POLLUTION

The Monongahela River and its tributaries have for a long time been abused by pollution resulting from large quantities of acid mine drainage, untreated sewage, and industrial waste.

Mine drainage, containing surfuric acid and acid salts, is the most damaging waste in the streams of the Monongahela River Basin. Acid mine drainage changes the natural chemical character of the water in the receiving streams. These chemical changes cause immeasurable damages, which result from the acid conditions of the stream waters. The water is expensive to treat for municipal and industrial uses. The acid waters are highly corrosive to steel and iron structures, such as boats, barges, bridge supports, culverts, pumps, and concrete structures. The stream is made unfit for recreational uses, such as fishing and swimming.

The biological processes are eliminated or altered to the point where the stream no longer sustains desirable aquatic life, including fish.

Calculations of estimated coliform bacteria densities were made on the Monongahela and West Fork Rivers to determine what levels might be expected to occur when acid wastes are reduced or acid concentrations lowered by increased stream flow. A population of 324,000 discharges raw and treated sewage to the Monongahela and Youghiogheny rivers and their tributaries in the reaches considered to the Allegheny County, Pennsylvania, line.

Industries, other than mines, discharge organic wastes having a combined oxygen demand equivalent to that from a population of approximately 250,000. The 1959 ORSANCO Report lists a total organic load of 664,000 population equivalents being discharged to the Monongahela and West Fork rivers. This includes both sewage and industrial wastes discharging directly to the main stem, and those discharging to the tributaries within 20 miles of confluence with the Monongahela or West Fork.

EFFECTS OF POLLUTION

Conditions and Damages - Monongahela River and Tributaries

Monongahela Main Stem (West Virginia-Pennsylvania)

Acid mine drainage, along with organic and bacterial pollution originating in the state of West Virginia, damaged the water quality both in West Virginia and at the State line. The river carried an acid load of 126 tons per day just below the State line. The residuals of these pollutants along with the added wastes in Pennsylvania, contributed to the degraded quality of the Monongahela in Pennsylvania.

The effects of the organic and bacterial pollution in the Monongahela are masked by the acid conditions of the streams. The masking effect reduces, but does not eliminate, the hazards associated with organic and bacterial pollution.

The calculated estimates of coliform bacteria densities in the Monongahela and West Fork rivers ranged up to 350 times the level of 5,000 coliforms per 100 ml, recommended by the Ohio River Valley Water Sanitation Commission for use as a source of water supply or for general recreation. The estimates ranged up to 1,650 times ORSANCO's recommended level of 1,000 coliforms per 100 ml for water contact sports. Calculated estimates of the coliform densities, under reduced acid conditions, show a potential of 70,000 per 100 ml at the State line. Severe biological degradation existed in the West Fork River from Gypsy, West Virginia, to its confluence with the Tygart to form the Monongahela, and in the Monongahela River across the State line at least to Charleroi, Pennsylvania. The calculated coliform densities indicate a health hazard in the use of the Monongahela as a source of domestic water supply and for recreation.

The acid conditions of the stream increased the cost of treating municipal and industrial water supplies taken from the Monongahela. The river, in general, was unfit for recreational uses, such as fishing, boating, and swimming. The biological processes were altered so that the river no longer sustained desirable aquatic life, including fish.

Youghiogheny River (West Virginia-Maryland)

No known sources of pollution exist above the State line along the upper reaches of the Youghiogheny. Interstate pollution was not found to occur in this reach of the river.

Snowy Creek (Tributary to the upper Youghiogheny and interstate between West Virginia and Maryland)

Acid mine drainage and bacterial pollution occurring in West Virginia damaged the Snowy Creek water quality in Maryland. The residual effects of these wastes, along with those contributed by Laurel Run, damaged the quality of the Youghiogheny downstream to Oakland, Maryland. Oakland uses the Youghiogheny as a source of water supply. Snowy Creek caused biological degradation of the Youghiogheny River in Maryland.

Laurel Run (Tributary to Snowy Creek and interstate between West Virginia and Maryland)

Acid mine drainage originating in West Virginia contributed to the severely degraded condition of Laurel Run at the Maryland State line. The residuals of these wastes contributed to the degraded quality of Snowy Creek and the Youghiogheny River in Maryland.

Casselman River (Tributary to the Youghiogheny and interstate between Maryland and Pennsylvania)

Bacterial pollution of the Casselman River, originating in Maryland, contributed to the bacteriologically degraded condition of the river at the State line. Acid mine drainage in Pennsylvania contributed to the additional degradation of the river prior to its confluence with the Youghiogheny. Flow from the Casselman River contributed to the degraded quality of the Youghiogheny River below Confluence, Pennsylvania.

Youghiogheny River (Maryland-Pennsylvania)

The State line crosses the Youghiogheny River in the Youghiogheny Reservoir pool. Just below the State line coliform bacteria densities of over 4,000 per 100 ml were present. These values are in excess of the 1,000 coliforms per 100 ml, recommended limit for water contact sports. The entire length of the Youghiogheny River Reservoir is used for water contact sports. Untreated sewage discharges from Friendsville, Maryland, contributed to these high coliform densities. Additional studies are needed to determine other possible sources contributing to the bacterial pollution.

Cheat River (Tributary to the Monongahela and interstate between West Virginia and Pennsylvania)

Acid mine drainage originating in West Virginia caused severe biological degradation of the Cheat River at the State line. The acid pollution originating in West Virginia, along with that contributed in Pennsylvania, added significant acid loads to the Monongahela River just downstream of the State line.

Dunkard Creek (Tributary to the Monongahela and interstate between West Virginia and Pennsylvania)

Acid mine drainage in Dunkard Creek caused severe biological degradation of the stream in its lower reaches. Additional studies are needed to determine the sources of acid drainage to Dunkard Creek. The stream is interstate at several points. The acid load discharged to the Monongahela by Dunkard Creek contributed to the degraded quality of the Monongahela in Pennsylvania.

Monetary Damages

Tangible Damages

Costs which can be expressed in dollars were estimated for damages that occur in the Monongahela to its confluence with the Allegheny at Pittsburgh.

The following table lists the damages for those items that can readily be estimated.

Annual Damages Due to Acid Conditions of the Monongahela River

	Annual Damages
Industrial Water Supplies	$1,220,000
Domestic Water Supplies	154,000
Boats	354,000
Barges	483,000
Lock and Dam Structures	40,000
Total	$2,251,000

Intangible Damages

No effort has been made to place a value on the damages to recreation, nuisance conditions, and public health hazards that are real, and are of equal or greater significance than those listed, but are intangible.

Physical damages to real property on which data were not available include damages to water intake structures and conveyance facilities, pumps, highway structures, the added expense of providing acid resistant facilities, and the damages to mining operations.

The damages considered as intangible in all probability equal or exceed those listed in the above $2,251,000 annual damages.

CONCLUSIONS

Pollution of the Monongahela River and its tributaries in several interstate reaches is evident. Pollution originating in West Virginia damaged the water quality at the Pennsylvania State line in the Monongahela and Cheat Rivers, and contributed to the degraded quality of the Monongahela downstream to Charleroi, Pennsylvania. Pollution also originating in West Virginia, in Snowy Creek and Laurel Run, damaged the water quality of the upper Youghiogheny in Maryland. Pollution originating in Maryland contributed to the high bacteria densities at and below the Maryland-Pennsylvania State line on the Casselman and Youghiogheny Rivers.

Acid mine drainage, untreated sewage, and industrial wastes discharged to the Monongahela River, Cheat River, Laurel Run, and Snowy Creek, in the state of West Virginia, constitute interstate pollution subject to abatement under the Federal Water Pollution Control Act, since the health and welfare of persons in states other than that in which the pollution originates are endangered.

INTRODUCTION

On August 7, 1963 the Secretary of Health, Education, and Welfare notified the states of Pennsylvania, West Virginia and Maryland that a conference was to be held in Pittsburgh, Pennsylvania on December 17 and 18, 1963 to consider the matter of the pollution of the interstate waters of the Monongahela River and its tributaries. The action was taken in accordance with Section 8 (c) (1), Federal Water Pollution Control Act, on the basis of reports that gave the Secretary reason to believe that pollution of the Monongahela River and its tributaries, originating in West Virginia and Maryland, was endangering the health or welfare of persons in Pennsylvania.

From August 14 through September 6, chemical, bacteriological, and physical studies were made of the Monongahela River System. From September 9 through 20, biological studies of the river system were conducted.

This report has been prepared on the results of the studies conducted during August and September, 1963. Additional information for the report was obtained from a U. S. Public Health Service Report prepared in 1943, and from various other reports and data made available by the pollution control agencies of the states of Pennsylvania, West Virginia, and Maryland, and the Ohio River Valley Water Sanitation Commission. The states of Pennsylvania and West Virginia are member states of ORSANCO.

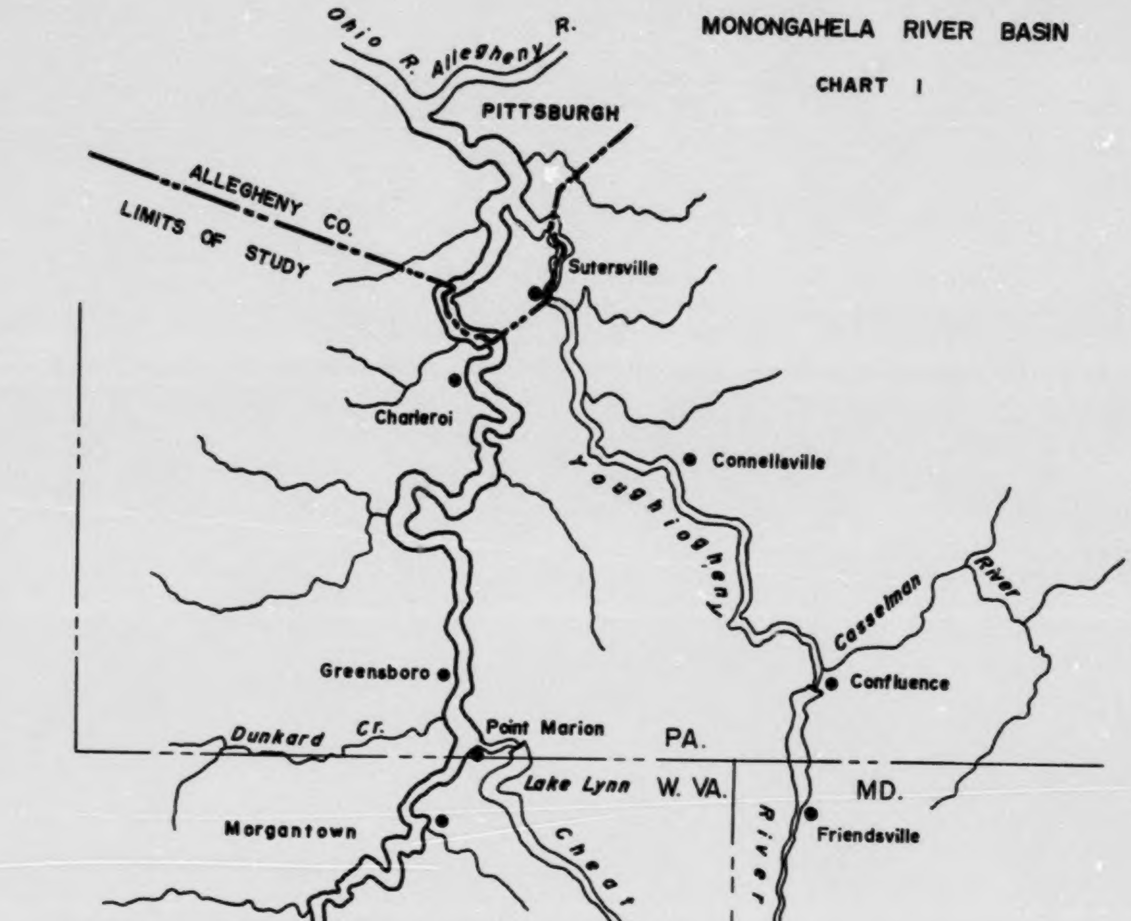
THE AREA

The Monongahela River is formed by the confluence of the West Fork and Tygart rivers at Fairmont, West Virginia. The drainage basin includes the southwest corner of Pennsylvania, the northeast portion of West Virginia, and a small section of western Maryland. The basin drains an area of 7,380 square miles. The river flows in a northerly direction and joins the Allegheny at Pittsburgh to form the Ohio River. The main stem of the Monongahela River flows through the Appalachian Plateau region and is characterized by rugged topography, with narrow stream valleys several hundred feet below the level of the uplands.

Major tributaries of the Monongahela are the Youghiogheny, Cheat, West Fork and Tygart rivers.

The section of the Monongahela of concern in this report extends downstream to Charleroi, Pennsylvania. The section of the Youghiogheny involved extends down to Sutersville, Pennsylvania. These sections are shown in Charts 1 and 1A.

Several stream reaches in the basin are of interstate concern. The main stem of the Monongahela is interstate as it flows from West Virginia into the state of Pennsylvania at river mile 91.25. The Cheat River is interstate between West Virginia and Pennsylvania, just upstream of its confluence with the Monongahela. Dunkard Creek, tributary to the Monongahela just below the West Virginia-Pennsylvania State line, crosses the State line at several points. The Youghiogheny River is interstate as it flows from West Virginia into Maryland, and again as it flows from Maryland into Pennsylvania. Casselman River, tributary



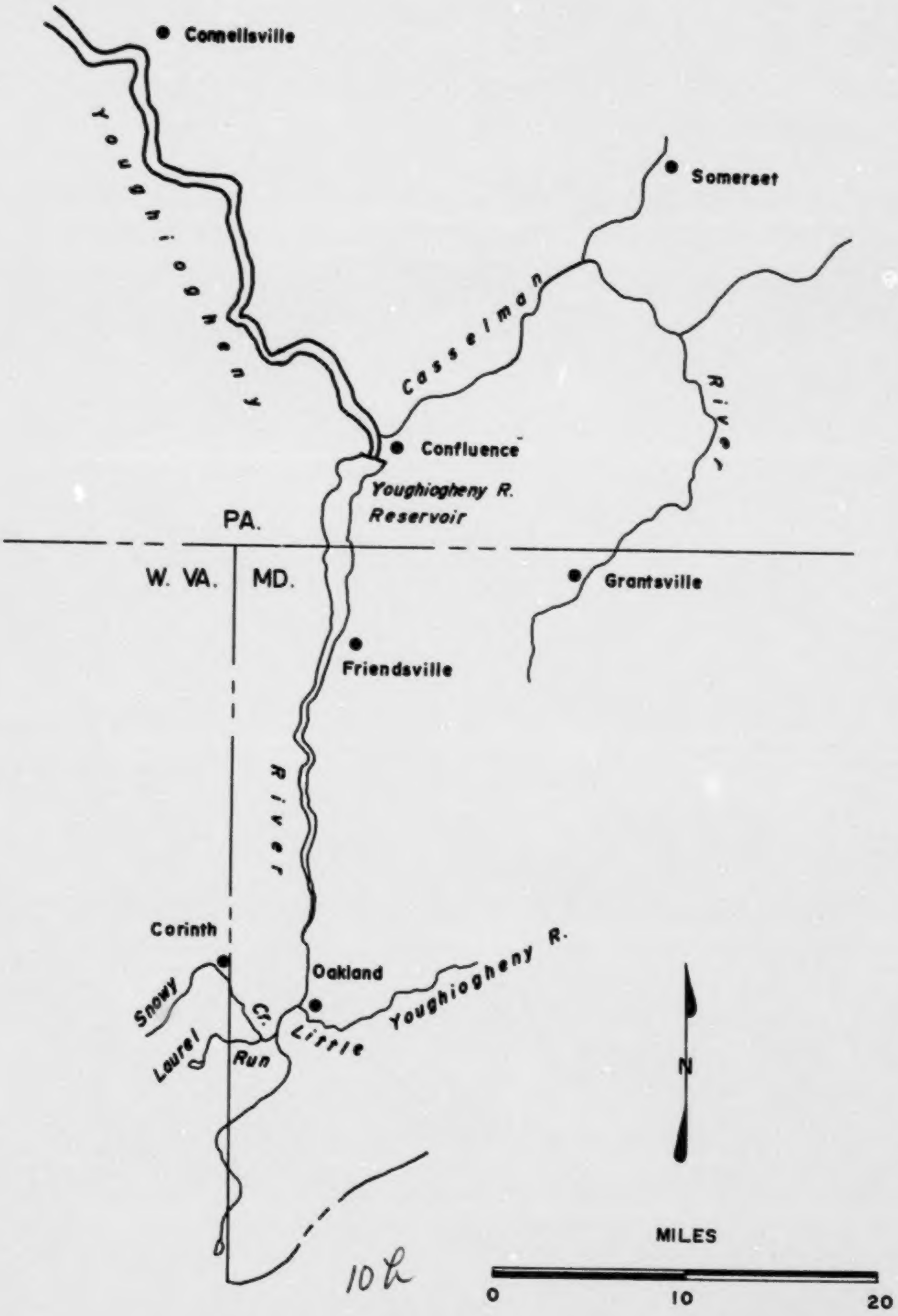
MONONGAHELA RIVER BASIN

CHART 1

Ohio R.
Allegheny R.
PITTSBURGH
ALLEGHENY CO.
LIMITS OF STUDY
Sutersville
Charleroi
Connellsville
Youghiogheny
Casselman River
Confluence
Greensboro
Point Marion
Dunkard Cr.
PA.
W. VA.
MD.
Lake Lynn
Morgantown
Cheat River
River
Friendsville
Fairmont
Tygart
Grafton
Oakland
Rowlesburg
Tygart River Reservoir
West Fork
Clarksburg
N
Weston
River
Parsons
Buckhannon
Elkins
MILES
0
10
20

YOUGHIOGHENY RIVER SUB BASIN

CHART IA


Connellsville
Youghiogheny
Somerset
Casselman
River
Confluence
Youghiogheny R. Reservoir
PA.
W. VA.
MD.
Grantsville
Friendsville
River
Corinth
Oakland
Youghiogheny R.
Snowy
Cr.
Little
Laurel
Run
N
MILES
0
10
20

10h

to the Youghiogheny, is interstate between Maryland and Pennsylvania. Laurel Run and Snowy Creek, tributaries to the Youghiogheny headwaters, are interstate between West Virginia and Maryland. Numerous other small streams in the basin are interstate, but little interstate pollution in these small streams was indicated by preliminary investigations.

The drainage area of the Monongahela upstream from Charleroi is 5213 square miles, and that of the Youghiogheny above Sutersville is 1715 square miles.

Four reservoirs are presently in operation in the Monongahela Basin. These are Lake Lynn on the Cheat, Deep Creek Reservoir on Deep Creek, tributary to the Youghiogheny, Tygart Reservoir on the Tygart Valley River, and the Youghiogheny Reservoir on the Youghiogheny. The four reservoirs provide approximately 700,000 acre feet of storage. Lake Lynn and Deep Creek Reservoirs are operated to produce peak-load power. The Tygart and Youghiogheny reservoirs are operated to provide low flow control.

The main stem of the Monongahela River is canalized for its entire length by 14 low lift locks and dams. Navigation depths of 8 feet are provided in the lower 90 miles, and 7 feet in the upper 38 miles.

SOURCES OF DATA

Current information for this report was obtained through a study of the chemical, biological, bacteriological, and physical conditions of the Monongahela River system during the latter part of August and September, 1963.

Valuable information and data also were obtained from the 1943 United States Public Health Service Ohio River Pollution Report (House Document No. 266, 78th Congress, August 27, 1943).

Additional data were available in the Ohio River Valley Water Sanitation Commission Report "Monongahela River - Sewage Treatment Considerations"; the Pennsylvania Department of Health, Division of Sanitary Engineering's "Report to the Sanitary Water Board on the Classification of the Main Stem of the Monongahela River"; the West Virginia Water Resources Commission's "Report on the Acid Mine Water Problem in the Snowy Creek-Laurel Run Area"; and several survey reports, along with field data made available by the Maryland Water Pollution Control Commission.

Sampling stations used during the August and September, 1963 study are listed in Table 1. The station locations are indicated on Chart 2.

Individual chemical results obtained during August and September are recorded in Appendix A. Biological findings at each of the selected stations are recorded in Appendix B.

Calculated estimates were made of the organic and bacteriological pollution that would occur, assuming that the acid conditions of the stream are improved, and other wastes remain constant. Bacteriological data collected during the August and September, 1963 study, along with the calculated estimates for the West Fork and Monongahela are recorded in Appendix C.

MONONGAHELA RIVER SYSTEM

STATION DESCRIPTIONS

TABLE NO. 1

STATION	RIVER MILE	DESCRIPTION
M-1	M- 41.4	Monongahela River near Charleroi, Pa. Station is located at Lock 4 on right river bank.
M-2A	M- 65.3	Monongahela River at the Millsboro, Pa. Water Treatment Plant.
M-2B	M- 70.6	Monongahela River at the Crucible Ferry Crossing near Crucible, Pa.
M-3	M- 85.0	Monongahela River near Greensboro, Pa. Station is located on land wall of Lock 7 on left river bank.
M-4	M- 90.7	Monongahela River near Pt. Marion, Pa. Station is located on land mass of Lock 8 on left river bank.
M-5	M- 98.0	Monongahela River near Morgantown, W. Va. Station is located where Highway 7 Bridge crosses the river.
M-6	M-124.6	Monongahela River near Fairmont, W. Va. Station is located at Lock 15 (Hoult, W. Va.).
MD-7	MD-87.1-3.5	Dunkard Creek near Shannopin, Pa. Station is located at U.S.G.S. Gaging Station 720.
MB-8	MB-125.4-3.0	Buffalo Creek near Barrackville, W. Va. Station is located at U.S.G.S. Gaging Station 615.
MW-9	MW-128.7-4.4	West Fork River south of Fairmont, W. Va. at the Highway 250 Bridge.
MW-10	MW-128.7-20.0	West Fork River near Gypsy, W. Va. at Highway 19 Bridge.

MONONGAHELA RIVER SYSTEM

STATION DESCRIPTIONS
(Continued)

TABLE NO. 1

STATION	RIVER MILE	DESCRIPTION
MW-11	MW-128.7- 31.9	West Fork River near Clarksburg, W. Va. at the U.S.G.S. Gaging Station 590.
MT-12	MT-128.7- 4.9	Tygart Valley River near Colfax, W. Va. at U.S.G.S. Gaging Station 570.
MT-13	MT-128.7- 18.6	Tygart Valley River near Grafton, W. Va. at Highway 50 Bridge.
MC-14	MC- 89.4- 3.5	Cheat River at Cheat Dam (Lake Lynn), Pa.
MC-15	MC- 89.4- 9.3	Cheat Lake at W. Va. State Highway 73 Bridge.
MC-16	MC- 89.4- 27.7	Cheat River north of Albright, W. Va. on State Highway 26.
MC-17	MC- 89.4- 45.0	Cheat River near Rowlesburg, W. Va. at U.S.G.S. Gaging Station 700 (R.R. Bridge).
MY-18	MY- 15.6- 12.4	Youghiogheny River near Sutersville, Pa. at U.S.G.S. Gaging Station 835.
MY-19	MY- 15.6- 44.4	Youghiogheny River in Connellsville, Pa. at the Crawford Avenue Bridge (State Highway 711).
MY-190	MY- 15.6- 58.7	Youghiogheny River near Ohiopyle, Pa. at Pa. Hwy. 381 Bridge (Bacteriological Only).
MY-20	MY- 15.6- 68.9	Youghiogheny River at Confluence, Pa. on State Highway 281 Bridge.
MY-21	MY- 15.6- 76.6	Youghiogheny Reservoir at U.S. Highway 40 Bridge (Pa.).
MY-210	MY- 15.6-111.9	Youghiogheny River west of Oakland, Md. just downstream from the B&O RR Bridge.

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MONONGAHELA RIVER SYSTEM

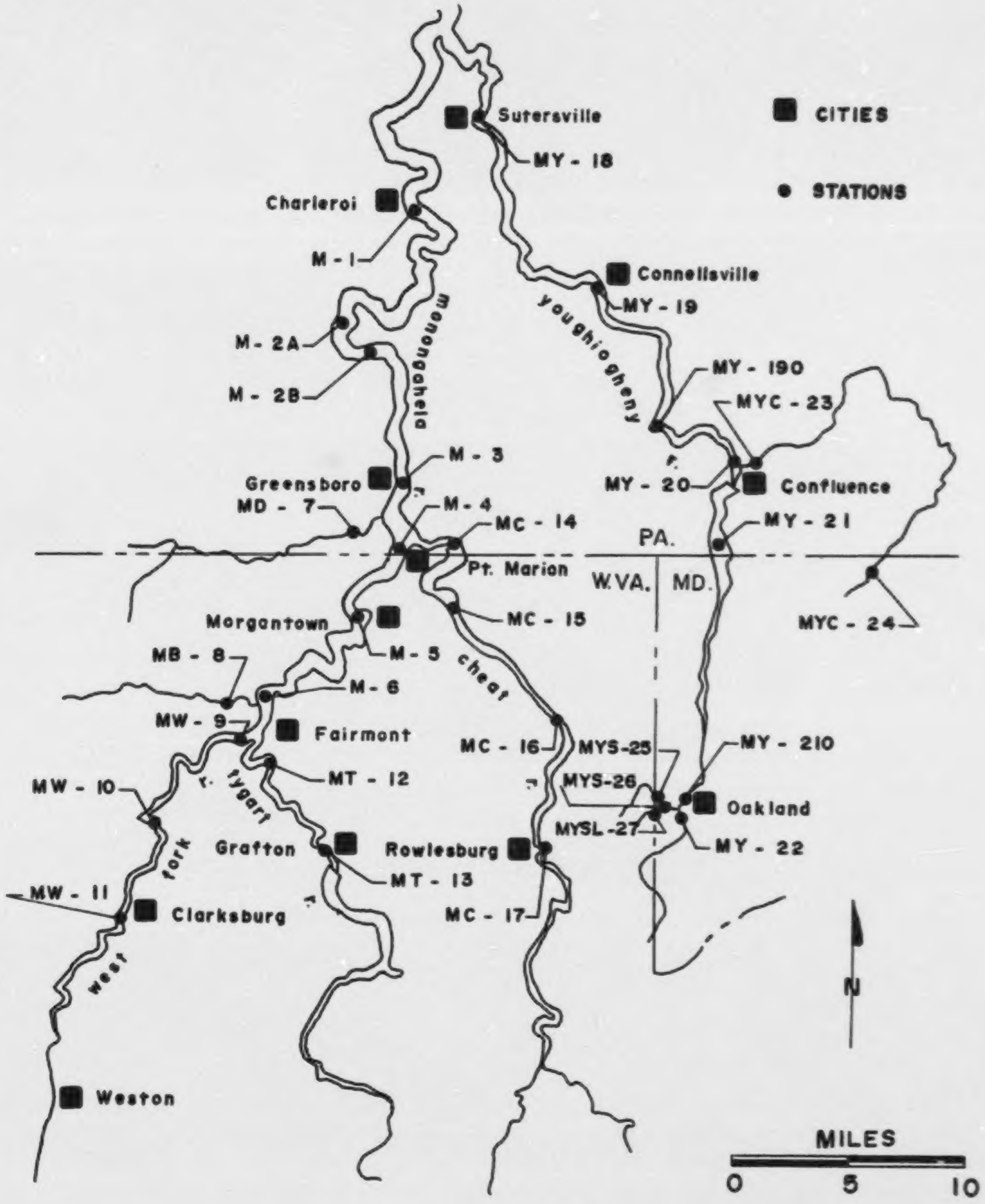
STATION DESCRIPTIONS
(Continued)

TABLE NO. 1

STATION	RIVER MILE	DESCRIPTION
MY- 22	MY -15.6-119.5	Youghiogheny River south of Oakland, Md. on Silver Knob Road (8/14-8/25); Mansfield Rd. (8/26-8/30).
MYC-23	MYC -15.6- 63.6- 1.0	Casselman River near Confluence, Pa. at State Highway 53 Bridge.
MYC-24	MYC -15.6- 63.6-40.5	Casselman River near Grantsville, Md. at the River Road Bridge.
MYS-25	MYS -15.6-116.4- 3.1	Snowy Creek near Corinth, W. Va. - Hutton, Md. at State Line off W. Va. State Highway 7.
MYS-26	MYS -15.6-116.4- 1.0	Snowy Creek near Crellin, Md. off State Highway 39 near Crellin Mine.
MYSL-27	MYSL-15.6-116.4- 0.7-0.2	Laurel Run near Crellin, Md. off State Highway 39 south of Snowy Creek Sampling Station.
MTU- 29	MTU -11.5- 7.0	Turtle Creek in Trafford, Pa. at Stewart Street Bridge.

12c

MONONGAHELA RIVER BASIN
SAMPLING STATIONS
CHART 2


■ CITIES
● STATIONS
Sutersville
MY - 18
Charleroi
M - 1
Connellsville
MY - 19
youghiogheny r.
monongahela r.
M - 2A
M - 2B
MY - 190
MYC - 23
M - 3
Greensboro
MY - 20
Confluence
MD - 7
M - 4
MC - 14
MY - 21
PA.
Pt. Marion
W.VA.
MD.
MYC - 24
Morgantown
MC - 15
MB - 8
M - 5
cheat r.
M - 6
MW - 9
Fairmont
MC - 16
MYS-25
MY - 210
MT - 12
MW - 10
MYS-26
Oakland
tygart r.
MYSL-27
MY - 22
Grafton
Rowlesburg
MT - 13
MW - 11
Clarksburg
MC - 17
west fork r.
N
Weston
MILES
0
5
10

Flow data for the 1963 study were obtained from the United States Geological Survey. The U.S.G.S. records indicate that flows during the study period were approximately one third the average annual flows, and were approximately 20 percent below normal flows for the period.

WATER USES

The entire length of the main stem of the Monongahela River is canalized for navigation purposes from the Golden Triangle in Pittsburgh to the confluence of the Tygart and West Fork rivers.

The Monongahela, West Fork, and Tygart rivers serve as the source of water supply for 26 major public water systems, upstream of the Allegheny County line. The 26 systems serve a population of 337,000 people, using approximately 41.8 million gallons per day (mgd). Fourteen of the 26 systems are in Pennsylvania, upstream of the Allegheny County line, serving a population of 223,800. An additional population of 421,500 using 60 mgd obtains domestic water from the Monongahela in Allegheny County. The Youghiogheny serves as the source of supply to 7 major public water systems serving 44,500 people, using 5.75 mgd. Six of the 7 systems are in Pennsylvania, serving a population of 42,500. The Cheat River serves as the source of 3 public water systems, serving 6,000 people, using 0.63 mgd. All 3 systems on the Cheat are in Pennsylvania. Table 2 lists the water systems using the main stems of the Monongahela, West Fork, Tygart, Cheat, and Youghiogheny rivers as sources of water supply. Included in the table are the population served by each of the systems and the estimated daily use.

Industrial uses of the Monongahela surface waters exceed 6,000 mgd, including 4,000 mgd for cooling water. About 1,700 mgd is treated for various industrial uses. Approximately 1,500 mgd is used

MONONGAHELA RIVER SYSTEM

Public Water Supplies Taken
From Main Rivers in the
Monongahela River Basin

TABLE NO. 2

WATER SUPPLY	Population Served	Average Consumption MGD
Allegheny Co. Line to W. Va. - Pa. State Line: Monongahela River		
So. Pittsburgh Water Co. - Shire Oaks	100,000	16.0
Monongahela City Water Co.	11,500	1.5
Authority of The Borough of Charleroi	60,000	6.0
Municipal Authority of The Borough of Belle Vernon	6,500	0.4
Municipal Authority of Washington Township	7,000	0.5
California Water Co.	3,000	0.2
Brownsville Water Co.	12,000	1.0
Tri-County Jt. Municipal Authority	3,500	0.6
Municipal Authority of The Borough of Carmichaels	2,000	0.2
Southwestern Pa. Water Authority	10,000	1.8
Masontown Municipal Water Works	5,000	0.5
Alicia Water Co.	200	0.01
U. S. Steel Corp.	1,500	0.09
Dunkard Valley Jt. Municipal Authority	1,600	0.07
SUB-TOTALS	223,800	29.65

MONONGAHELA RIVER SYSTEM

Public Water Supplies Taken From Main Rivers in the Monongahela River Basin

TABLE NO. 2

WATER SUPPLY		Population Served	Average Consumption MGD
Tygart River in West Virginia			
Phillippi		2,230	0.21
Elkins		8,300	1.20
Tygart Valley Homesteads		3,000	0.39
	SUB-TOTALS	13,530	1.80
Cheat River in Pennsylvania			
Pt. Marion		1,850	0.10
Lake Lynn		100	0.01
Spring Hill Township		4,000	0.52 (1)
	SUB-TOTALS	5,950	0.63
Cheat River in West Virginia			
NONE			

MONONGAHELA RIVER SYSTEM

Public Water Supplies Taken From Main Rivers in the Monongahela River Basin

TABLE NO. 2

WATER SUPPLY		Population Served	Average Consumption MGD
Monongahela River in West Virginia			
Morgantown		45,000	4.15
Booth		500	0.065 (1)
National		300	0.039 (1)
Everetteville		500	0.065 (1)
Jordan		400	0.052 (1)
	SUB-TOTALS	46,700	4.44
West Fork River in West Virginia			
Spelter		550	0.19
Clarksburg		42,000	4.9
Weston		9,000	0.5
Weston State Hospital		2,000	0.26 (1)
	SUB-TOTALS	54,000	5.91

MONONGAHELA RIVER SYSTEM

Public Water Supplies Taken From Main Rivers in the Monongahela River Basin

TABLE NO. 2

14d

WATER SUPPLY		Population Served	Average Consumption MGD
Youghiogheny River in Pennsylvania			
Smithton		650	0.03
Bannington		500	0.025
Buena Vista		10,000	0.45
Connellsville		12,800	2.5
Whitsett		550	0.19
No. Fayette Co. Municipal Authority		18,000	2.3
	SUB-TOTALS	42,500	5.495
Youghiogheny River in Maryland			
Oakland		2,000	0.26
	SUB-TOTALS	2,000	0.26

MONONGAHELA RIVER SYSTEM

Public Water Supplies Taken
From Main Rivers in the
Monongahela River Basin

TABLE NO. 2

14C

WATER SUPPLY	Population Served	Average Consumption MGD
Totals of Water Supplies By Rivers:		
Main Stem Monongahela River	270,000	34.09
West Fork River	54,000	5.91
Tygart River	13,530	1.80
Cheat River	5,950	0.63
Youghiogheny River	44,500	5.75
Totals of Water Supplies By States:		
Pennsylvania	272,250	35.97
West Virginia	114,230	12.15
Maryland	2,000	0.26

(1) Values Based on Estimated Use of 130 Gal./Cap./Day.

upstream of the Allegheny County line.

Industrial use of the Youghiogheny is centered primarily in that area downstream of the Allegheny County line.

The Monongahela River system is used extensively for the disposal of sewage and industrial waste, and for the conveyance of acid mine drainage.

The upper section of the Monongahela is presently used to a limited extent for recreation including boating, bathing, and water skiing. These recreational uses also occur on the West Fork, Tygart, Cheat, and Youghiogheny. Fishing is limited to those reaches and tributaries not adversely affected by excessive acid mine drainage. With the increasing popularity of aquatic recreational activities, it is anticipated that this use will increase, particularly if there is improvement in water quality.

Two reservoirs are operated in the basin to produce peak load power. These are Lake Lynn on the Cheat River near the West Virginia-Pennsylvania State line, and Deep Creek reservoir on Deep Creek, a tributary to the Youghiogheny in Maryland. Two reservoirs are operated for low flow control. These are Tygart Reservoir on the Tygart River, and the Youghiogheny Reservoir on the Youghiogheny.

The Cheat River is used as a source of cooling water by the thermal electric plant at Albright, West Virginia.

SOURCES OF WASTES

GENERAL

The major pollutional problem in the Monongahela Basin is the acid mine drainage. The acidity of the streams, resulting from acid mine drainage, has caused great damage to water uses and has served as an excuse to postpone the abatement of organic and bacterial pollution.

The 1943 U. S. Public Health Service Report states that an original load of 920,000 tons of acid (to phenolphthalein - hot) in mine drainage was discharged to the basin streams annually. Through a mine sealing program, this annual load had been reduced to 646,000 tons by 1940. The report indicated that an additional 199,000 tons per year could be removed economically by a continued sealing program. Supplement C of the 1943 Public Health Service Report, titled "Acid Mine Drainage Studies", pointed out that probably not over 10 percent of the total mine acid load came from working mine areas. This indicated that 90 percent came from completely abandoned mines, abandoned sections of active workings, or from the disposal of low grade coal and other waste materials from both working and abandoned mines.

Current information on the numbers of active and abandoned mines discharging acid to the streams is not presently available. Information provided by the West Virginia State Department of Mines shows that 496 active mines, 407 underground and 89 surface, were operating in the West

Virginia section of the Monongahela Drainage Area in 1962. Determining the location and quantities of acid discharges will require extensive investigations and studies.

MONONGAHELA, WEST FORK, AND TYGART RIVERS

In the reach considered, to the Allegheny County line, a total population of 248,000 discharges sewage to the Monongahela, West Fork, and Tygart rivers. In addition to the population discharging wastes to the streams, industries, other than mines, discharge organic wastes having a combined oxygen demand equivalent to that from a population of approximately 250,000.

Communities discharging sewage to the Monongahela and tributaries are listed in Tables 3 and 3A. Bacterial discharges of each of the municipalities discharging to the Monongahela, West Fork, and Tygart are indicated on Charts 7 and 7A. Known industries are listed in Appendix D. The potential effect of the municipal and industrial wastes on the river cannot be evaluated from the river sampling data because of the acid conditions of the stream during the study. Such an evaluation would require extensive studies on the specific waste discharges.

The 1959 ORSANCO Report lists a total organic load of 664,000 population equivalents (PE) being discharged to the Monongahela and West Fork rivers. This includes wastes from municipalities and industries discharging directly to the West Fork and Monongahela rivers, and those discharging to the tributaries within 20 miles of confluence with the Monongahela or West Fork.

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles * Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
CHEAT RIVER	89.5				
Rowlesburg, W. Va.	45	1,450	P & Cl	0.05	72
Salt Lick Creek	45				
Terra Alta, W. Va.	45-10	1,470	N	1.00	1,470
Indians Creek	34				
Kingwood, W. Va.	34-2	2,000	N	1.00	2,000
W. Va. - Penn. State Line	3.5				
Lake Lynn, Pa.	3	100	N	1.00	100
MONONGAHELA RIVER					
Dunkard Creek	87.1				
Brave, Pa.	87.1-14	150	P	0.50	80
Mount Morris, Pa.	87.1-11	100	N	1.00	100
Bobtown, Pa.	87.1- 6	1,820	P	0.50	910
Shannopin Coal Co.	87.1- 3	670	P	0.50	340
Georges Creek	84.9				
Fair Chance, Pa.	84.9-11	200	N	1.00	200
Gallatin Joint School	84.9- 7	580	(Sc)P	(.30) .15	90
Greensboro, Pa.	84	800	P	0.50	400
Grays Landing, Pa.	81	100	N	1.00	100

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
MONONGAHELA RIVER (Cont.)					
Coal Center, Pa.	51	200	N	1.00	200
Elco, Pa.	48	500	N	1.00	500
Roscoe, Pa.	48	1,400	N	1.00	1,400
Stockdale, Pa.	47	800	N	1.00	800
Allenport, Pa.	46	400	N	1.00	400
Fayette City, Pa.	46	1,600	N	1.00	1,600
Dunlevy, Pa.	46	400	N	1.00	400
Downers Run	46				
Fayette Co. Housing Auth.	46.2	380	S	0.10	40
Belle Vernon, Pa.	43	2,350	N	1.00	2,350
North Belle Vernon, Pa.	43	2,900	N	1.00	2,900
Speers, Pa.	43	800	N	1.00	800
Twilight, Pa.	43	320	N	1.00	320

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
MONONGAHELA RIVER (Cont.)					
Dunlap Creek	56				
New Salem, Pa.	56-11	600	N	1.00	600
Menallen Twp. School	56- 8	400	(Sc) P	(0.30) 0.15	60
Republic-Cardale, Pa.	56- 5	600	N	1.00	600
Fayette Co. Housing Auth.	56- 3	500	S	0.075	40
Brownsville, Pa.	56	7,000	N	1.00	7,000
West Brownsville, Pa.	56	1,500	N	1.00	1,500
Redstone Creek	55				
Uniontown, Pa.	55-17	25,000	S	0.10	2,500
Enterprise Co.	55-16	100	S	0.10	10
Franklin Co. School	55- 8	500	(Sc) P	(0.30) 0.15	80
Smock, Pa.	55- 6	2,800	N	1.00	2,800
California, Pa.	52	2,600	N	1.00	2,600
State Teachers College	52	900	(Sc) N	(0.3)	270
Pike Run	51.3				
Centerville, Pa.	51.3-4	1,200	S	0.10	120
Crescent Heights	51.3-2	600	P	0.50	300

17C

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
MONONGAHELA RIVER (Cont.)					
Masontown, Pa.	79	3,000	N	1.00	3,000
Nemacolon, Pa.	76	2,500	N	0.50	1,200
Muddy Creek	73				
Carmichaels, Pa.	73-4	2,700	P	0.50	1,350
Rices Landing, Pa.	68	150	N	1.00	150
Ten Mile Creek	66				
Bethlehem Mines Co.	66-10	400	P	0.50	200
Marianna, Pa.	66- 5	1,100	N	1.00	1,100
Bethlehem Joint Schools	66- 4	760	(Sc) P	(.30) .15	120
Wash. Co. Housing Auth.	66- 3	300	S	0.10	30
Clyde #3	66- 3	750	N	1.00	750
So. Fork Ten Mile Creek	66- 2				
Waynesburg, Pa.	66- 2-16	6,000	S	0.10	600
Jefferson, Pa.	66- 2- 6	440	N	1.00	440
Clyde #2	66- 2- 3	350	P	0.50	180
Teagarden Homes	66- 2- 0	600	P	0.50	300
Clarksville Muni.San.Auth.	66- 2- 0	100	N	1.00	100
Luzerne Twp., Pa.	66	1,300	N	1.00	1,300
Fredericktown-Millboro	65	300	N	1.00	300

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
TYGART RIVER	(128.7)				
Grafton, W. Va.	18.6	7,400	N	1.00	7,400
MONONGAHELA RIVER					
Fairmont, W. Va.	127	25,000	N	1.00	25,000
Buffalo Creek	126.5				
Mannington, W. Va.	126.5-14	3,160	N	1.00	3,160
Farmington, W. Va.	126.5- 8	880	N	1.00	880
Paw Paw Creek	122.6				
Fairview, W. Va.	122.6-11	830	P & Cl	0.05	40
Grant Town, W. Va.	122.6- 5	2,100	N	1.00	2,100
Rivesville, W. Va.	123	1,550	P	0.50	780
Deckers Creek	101				
Reedsville, W. Va.	101-17	320	P & Cl	0.05	20
Masontown, W. Va.	101-12	910	N	1.00	910
Morgantown, W. Va.	101	26,000	N	1.00	26,000
Westover, W. Va.	101	1,750	N	1.00	1,750
Star City, W. Va.	98	1,770	N	1.00	1,770
W. Va. - Penn. State Line	91.2				
Point Marion, Pa.	90	3,300	N	1.00	3,300

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
WEST FORK RIVER	(128.7)				
Weston, W. Va.	61	8,300	P & Cl	0.05	420
State Hospital	61	3,000	S & Cl	0.01	30
4-H Camp	57	500	P	0.50	250
Hacker Creek	50				
Jane Lew, W. Va.	50-4	500	N	1.00	500
Elk Creek	31				
Nutter Fort, W. Va.	31-4	2,300	N	1.00	2,300
Clarksburg, W. Va.	30	20,000	N	1.00	20,000
Simpson Creek	23				
Bridgeport, W. Va.	23-8	1,600	N	1.00	1,600
10 Mile Creek	19				
Salem, W. Va.	19-13	3,000	S & Cl	0.01	30
Lumberport, W. Va.	19-1	1,300	N	1.00	1,300
Shinnstown, W. Va.	15	2,800	N	1.00	2,800
Worthington, W. Va.	10	350	N	1.00	350
Monongah, W. Va.	4.3	1,800	P & Cl	0.05	90

MONONGAHELA RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3

LOCATION	River Miles* Above Mouth	Est. Pop. Served**	Treatment Provided***	Est. Proportion Coliform Remaining****	Est. B.P.E.***** to Streams
MONONGAHELA RIVER (Cont.)					
Charleroi, Pa.	41	10,500	N	1.00	10,500
North Charleroi, Pa.	41	2,650	N	1.00	2,650
Monessen, Pa.	39	18,000	N	1.00	18,000
Donora, Pa.	36	13,200	N	1.00	13,200
Allegheny Co. Line	35				

* River miles from Jan. 1961 Rev. of U. S. Army Monongahela River Navigation Charts.

** Based on estimated 1963 sewered population.

*** Treatment facilities; existing and under construction. Proposed treatment facilities in those cases where Federal Treatment Plant Construction Grants have been authorized.

Type of Treatment: P = Primary Treatment
S = Secondary Treatment
Cl = Chlorination
Sc = School (assume .30 BPE/student)

**** Estimated proportion coliform remaining: P = 50% remaining
S = 10% "
P & Cl= 5% "
S & Cl= 1% "

***** Bacterial Population Equivalent

YOUGHIOGHENY RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3-A

17h

Location	River Miles Above Confluence With Monongahela R.	Estimated Population Served**	Treatment Provided***	Estimated Proportion Coliform Remaining****	Estimated B.P.E. ***** To Stream
Casselman River					
Grantsville, Md.	70-51	470	P	0.50	235
Pa. - Md. State Line	70-47				
Salisbury, Pa.	70-44	100	N	1.00	100
Myersdale, Pa.	70-34	2600	N	1.00	2600
Myersdale Joint School District		800	P	0.50	400
Buffalo Creek	70-28				
Berlin, Pa.	70-28-8	250	P	0.50	125
Garrett, Pa.	70-28	500			
Coxes Creek	70-22				
Somerset, Pa.	70-22-9	5400	S	0.10	540
Rockwood, Pa.	70-22	850	N	1.00	850
Confluence, Pa.	70-0.1	800	N	1.00	800
Youghiogheny River					
Oakland, Md.	114	1640	N	1.00	1640

YOUGHIOGHENY RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3-A

Location	River Miles Above Confluence With Monongahela R.	Estimated Population Served**	Treatment Provided***	Estimated Proportion Coliform Remaining****	Estimated B.P.E.***** To Stream
Friendsville, Md.	87	500	N	1.00	500
Pa. - Md. State Line	80				
Dunbar Creek	44				
Dunbar, Pa.	44-3	400	N	1.00	400
So. Connellsville, Pa.	44	2550	P	0.50	1275
Connellsville, Pa.	42	12,900	P	0.50	6450
Mounts Creek	42				
Bullskin Twp. School Dist.	42-5	800	S	0.10	80
Dickerson Run	37				
Vanderbilt, Pa.	37-1	500	N	1.00	500
Dawson, Pa.	37	780	N	1.00	780
Washington Run	31				
Star Junction, Pa.	31-3	120	N	1.00	120
Perryopolis	31-1	1900	S	0.10	190
Perry Twp., Pa.	31-1	120	N	1.00	120
Jacobs Creek	27				
Shupes Run	27-15				
Mt. Pleasant Twp.	27-15-3	5300	N	1.00	5300

YOUGHIOGHENY RIVER SYSTEM

ESTIMATED TOTAL COLIFORM BACTERIAL LOADS TO STREAMS - 1963

TABLE NO. 3-A

Location	River Miles Above Confluence With Monongahela R.	Estimated Population Served**	Treatment Provided***	Estimated Proportion Coliform Remaining ****	Estimated B.P.E.***** To Stream
Jacobs Creek	27				
Everson, Pa.	27-11	1600	N	1.00	1600
Scottdale, Pa.	27-11	6300	N	1.00	6300
Smithton, Pa.	24	325	N	1.00	325
West Newton, Pa.	18	2200	N	1.00	2200
Sewickley Creek	17				
Calumet, Pa.	17-20	700	P	0.50	350
Jacks Run	17-17				
Greensburg, Pa.	17-17-6	21,600	P	0.50	10,800
Youngwood, Pa.	17-17-1	2500	N	1.00	2500

** Based on estimated 1963 sewered population.

*** Treatment facilities; existing and under construction. Proposed treatment facilities in those cases where Federal Treatment Plant Construction Grants have been authorized.

Type of Treatment: P = Primary Treatment
S = Secondary Treatment
Cl = Chlorination
Sc = School (assume .30 BPE/student)

**** Estimated proportion coliform remaining: P = 50% remaining
S = 10% "
P & Cl= 5% "
S & Cl= 1% "

***** Bacterial Population Equivalent

The December 1962 Pennsylvania Department of Health Report to the Sanitary Water Board on the Main Stem of the Monongahela River states in part " . . . about 78,000 . . . people discharge sewage to the Monongahela River between the West Virginia-Pennsylvania State line and the Allegheny County line . . ."

In the reach between the State line and the Allegheny County line, the principal sources of acid mine drainage to the main stem of the Monongahela are from Cheat River, Dunkard Creek, Georges Creek, Whitely Creek, Cats Creek, Jacobs Creek, and Browns Run.

CHEAT RIVER

The Cheat River receives acid mine drainage and the sewage from four municipalities with a total population of approximately 5,000 (Chart 7C). In Pennsylvania several acid mine discharges and the wastes from a coal washing operation enter the Cheat River below Lake Lynn prior to its confluence with the Monongahela.

DUNKARD CREEK

Dunkard Creek receives acid mine discharges, and sewage from a population of 2,700 (Chart 7).

YOUGHIOGHENY RIVER

Snowy Creek and Laurel Run, tributary to the upper Youghiogheny (Chart 7B), receive the acid water discharges of 5 strip mines, 31 dry drift mine openings (19 of which are located inside the strip mine areas), 3 mine openings and 6 boreholes in a combined drainage area of 21 square miles in West Virginia. Snowy Creek also receives sewage discharges from the Corinth-Terra Alta, West Virginia areas.

The Youghiogheny is again of interstate concern as it flows from Maryland into Pennsylvania. In that section between the points of interstate concern the Youghiogheny receives waste discharges in the Oakland, Maryland area below the confluence with the Little Youghiogheny. However, this problem is intrastate, and not interstate. Friendsville, Maryland, discharges raw sewage to the Youghiogheny upstream of the Youghiogheny Reservoir, through which the State line crosses.

The Youghiogheny River between the Maryland-Pennsylvania State line and the Allegheny County line receives additional acid mine drainage from Casselman River and in the reach upstream of Sutersville. The Youghiogheny drainage area in Pennsylvania receives sewage discharges from approximately 66,000 people.

CASSELMAN RIVER

The Casselman River is tributary to the Youghiogheny and is interstate between Maryland and Pennsylvania. The upstream reaches of the Casselman receive some acid discharges. Grantsville, Maryland, discharges inadequately treated sewage to the Casselman just upstream of the State line.

TREATMENT FACILITIES PROVIDED

Municipalities presently providing treatment include Weston, Monongah, Philippi, and Rivesville, West Virginia; and Uniontown, Bobtown, Waynesburg, Centerville, Somerset, Perryopolis, Connellsville, Jefferson Township, Tea Garden Homes-Morgan Township, Berlin, and Peters Township, Pennsylvania.

In 1944, the main stem of the Monongahela River from the West Virginia-Pennsylvania State line to the Allegheny County line was classified by the Sanitary Water Board of Pennsylvania as requiring primary treatment of waste discharges. In 1945 and 1946 the Sanitary Water Board issued orders to municipalities and industries on the Monongahela to abate the discharge of wastes to the waters of the Commonwealth, and to prepare plans for the necessary treatment works. Most of the municipalities and industries complied with the order to prepare plans. However, the majority at present continue to discharge untreated wastes to the Mononghela River.

In August, 1963, the Division of Sanitary Engineering, Pennsylvania Department of Health, submitted a report to the Sanitary Water Board on the Classification of the Main Stem of the Monongahela River. Work on the report was initiated in 1962. As a result of the report, numerous hearings have been recently scheduled by the Sanitary Water Board. During the month of September, 1963, Sanitary Water Board Hearings were held for the following: (Note: This list does not include 4 municipalities in Allegheny County for which hearings were held) Brownsville, Fayette City Borough, Belle Vernon, Point Marion, Greensboro, New Eagle, California, Donora, Monessen, Charleroi, Stockdale, Elco, Roscoe, Allenport, Dunlevy, City of Monongahela, West Brownsville, North Charleroi, and Speers. A Sanitary Water Board Hearing was held for North Belle Vernon in October, 1963.

The following hearings are scheduled before the Sanitary Water Board in December: Newell Borough, Dunbar Township, Brownsville Township, Dawson Borough, Dunbar Borough, Fairchance Borough, Masontown Borough, Smithfield Borough, Vanderbilt Borough, Perry Township, Carmichaels Borough, Rices Landing, Cokesburg Borough, East Bethlehem Township, Marianna Borough, Irwin Borough, Export Borough, Hempfield Township, Manor Borough, Rostraver Township.

Information included in Tables 3 and 3A indicates that 33 percent of the sewered population in the Monongahela Basin in West Virginia is served by some degree of treatment; in Pennsylvania, 45 percent upstream of Allegheny County; and, in Maryland, 18 percent.

EFFECTS OF WASTES ON WATER QUALITY AND USES

GENERAL

Mine drainage, containing sulfuric acid and acid salts (sulfates), which reaches the surface streams in the bituminous coal mining area in West Virginia, Maryland, and Pennsylvania, is the most damaging waste in the Monongahela River Basin. In 1961 West Virginia was the leading bituminous coal producing state in the country with a production of over 113 million tons. Pennsylvania was third with over 62 million tons.

Mine drainage is rendered acid by chemical and possibly biochemical reactions involving water, oxygen, and the sulfur in pyrite, marcasite, and other minerals and ores commonly found with coal deposits.

Acid mine drainage changes the natural chemical character of the water in streams. These changes are produced by the reaction of the acid with the natural alkalinity in the stream, resulting in the conversion of carbonate to non-carbonate hardness, and lowering the pH values. The acid waters flowing over calcium or magnesium bearing rock formations dissolve additional calcium and magnesium with further increases in hardness.

The effects of the organic and bacterial pollution on the receiving waters are in general masked by the acid conditions. The inhibiting effect of the acid conditions on bacteria and the coagulating action of the iron salts on organic wastes reduce or prevent odor and nuisance conditions which otherwise would occur in many stream reaches during the normal stream flows. However, sludge deposits and floating sewage materials are present at and below sewer outlets. The acid condition of a stream is not a constant safeguard to public water supplies and public health, since high flows may temporarily eliminate the acid conditions in a stream and allow sewage bacteria to survive. At such times, the need for germicidal effect is great.

The results of the chemical changes in streams receiving excessive acid discharges are severe and cause considerable damage. The water is expensive and difficult to treat for municipal and certain industrial uses. The stream is highly corrosive to steel and iron structures, such as barges, boats, bridge supports, culverts, pumps, and concrete structures. The stream is made unfit for recreational uses such as fishing, boating, and swimming. The biological processes are either eliminated or altered to the point where the stream no longer sustains desirable aquatic life, including fish.

The masking of the organic and bacterial pollution in the Monongahela Basin by the acid conditions does not reduce the degrading capabilities of these wastes. The reduction of either the acid loads or the organic wastes alone will not return the streams to their most useful condition. The usefulness of the streams is damaged by both, and both should be reduced.

COMPARISON - 1940-1963 DATA

The 1943 U. S. Public Health Service Report (House Document 266 - 78th Congress) contained an estimate that a 1940 load of 646,000 tons of acid was being discharged to the Monongahela Basin annually. A comparison of the 1940 and 1963 conditions of the surface waters is presented in Table 4. It is not intended to imply that the results of the two surveys are fully comparable. The results obtained indicate the conditions of the stream at the times of sampling only.

The 1940 samples were obtained at intermittent intervals during the period May through December over a wide range of river discharges. The 1963 chemical data were collected during the latter two weeks of August, with a relatively narrow range of discharges. Data used from the 1940 study in Table 4 are those results obtained at the same stations used in 1963, and at periods of most nearly comparable stream flows.

MONONGAHELA RIVER SYSTEM

CHEMICAL COMPARISON: 1940 AND 1963

TABLE NO. 4

STATION	RIVER MILE	pH		Flow in cfs		Hot Acidity As $CaCO_3$				Alkalinity As $CaCO_3$				Hardness as $CaCO_3$		Date in 1940	
		1940	1963	1940	1963	1940		1963		1940		1963		1940	1963	MONTH	DAYS
						mg/1	tons/day	mg/1	tons/day	mg/1	tons/day	mg/1	tons/day	mg/1	mg/1		
M-1	M- 41.4	3.6	4.0	1916	2402	35	181	24	156	-	-	-	-	105	173	Oct.	2, 8, 17, 22, 30
M-3	M- 85.0	3.8	3.8	1476	2441	21	84	22	145	-	-	-	-	-	106	Oct.	2, 8, 17, 22, 30
M-4	M- 90.7	3.8	3.9	1090	1940	21	62	24	126	-	-	-	-	-	133	Oct.	2, 8, 17, 22, 30
M-5	M- 98.0	4.0	4.1	2150	1710	46	267	23	106	-	-	-	-	-	143	May	16, 23
M-6	M-124.6	4.5	5.5	4230	1544	20	228	16	67	5	57.0	4	17	-	145	June	4, 12, 26
MD-7	MD- 87.1-3.5	-	2.8	-	4.8	-	-	858	11	-	-	-	-	-	1026	-	-
MB-8	MB-125.4-3.0	5.2	7.2	150	13.3	24	9.7	-	0	10	0.4	93	3.3	-	359	June	4
MW-9	MW-128.7-4.4	3.6	4.1	780	501	58	122	28	38	-	-	-	-	-	265	June	12, 26
MW-10	MW-128.7-20.0	4.8	4.1	490	315	26	34.4	70	59.5	3	4.0	-	-	-	402	May; July	20; 10
MW-11	MW-128.7-31.9	6.6	6.8	280	200	-	-	3	2	23	17.4	27	15	-	209	June; July	28; 2, 10
MT-12	MT-128.7- 4.9	6.8	6.0	1630	1094	-	-	2	6	-	-	4	11	27	42	June	28
MT-13	MT-128.7-18.6	6.8	5.7	1620	1040	-	-	4	11.2	-	-	3	8.4	-	42	June	28
MC-14	MC- 89.4- 3.5	6.1	4.5	1220	1330	-	-	10	35.9	8	26.4	1	3.6	-	45	June	22
MC-15	MC- 89.4- 9.3	6.5	5.1	1220	1300	-	-	5	17.5	8	26.4	3	10.5	-	40	June	22
MC-16	MC- 89.4-27.7	6.9	6.1	1600	960	-	-	4	10.4	29	125	5	13	-	36	June	24
MC-17	MC- 89.4-45.0	6.9	6.7	1550	913	-	-	2	5.0	28	117	10	25	-	28	June	24
MY-18	MY- 15.6-12.4	4.5	5.5	845	859	4	9.1	11	26	-	-	4	9	77	84	Sept.	19
MY-19	MY- 15.6-44.4	6.9	6.6	1020	802	-	-	2	8	12	33	5	2	42	37	Nov.	18
MY-20	MY- 15.6-68.9	5.4	6.4	755	772	9	18.4	2	4	7	14.3	7	1	-	22	July	16, 25
MY-21	MY- 15.6-76.6	5.4	6.4	318	121	8	6.9	2	0.65	8	6.9	8	3.6	-	21	July	16, 25
MY-210	MY- 15.6-111.9	5.3	6.6	382	83	14	14.4	3	0.67	20	20.6	11	2.5	32	34	June	18, 24
MY-22	MY- 15.6-119.5.	-	6.7	-	78	-	-	2	0.42	-	-	14	3	-	24	-	-
MYC-23	MYC-15.6- 63.6-1.0	3.9	4.2	285	55	28	21.5	34	5	-	-	-	-	-	185	July	16, 25
MYC-24	MYC-15.6- 63.6-40.5	3.2	6.2	33	13.5	110	9.8	2	0.07	-	-	15	0.55	-	85	July	24
MYS-25	MYS-15.6-116.4-3.0	5.5	6.4	86	36	7	1.6	4	0.39	19	4.4	12	1.2	31	38	June	18
MYS-26	MYS-15.6-116.4-1.0	-	6.3	-	36	-	-	4	0.39	-	-	13	1.3	-	35	-	-
MYSL-27	MYSL-15.6-116.4-0.7-0.2	-	3.5	-	20	-	-	65	3.5	-	-	-	-	-	64	-	-

NOTE: (1) Data shown for 1940 taken from: Ohio River Pollution Control - Report of the U. S. Public Health Service, 78th Congress, 1st Session, House Document No. 266 U. S. Government Printing Office, Washington: 1944.

(2) Dates used in 1940 selected on basis of most comparable flows between 1940 and 1963.

DEFINITIONS: Methods of Analyses

Because of the variety of methods used in determining acidity and alkalinity values, it is pertinent to describe the methods used to obtain the results of the August and September, 1963 study.

Term	Definition
1. Hot Phenolphthalein Acidity ("Standard Methods" 11th Ed. Page 340)	"Total Potential Mineral Acidity".
2. Cold Phenolphthalein Acidity	"Total Acidity" by Standard Methods. Includes CO_2 but not all of the hydrolyzable salts.
3. Cold Methyl Orange ($pH < 4.5$)	"Free Mineral Acidity".
4. Cold Methyl Orange ($pH > 4.5$)	"Methyl Orange Alkalinity".
5. Acid Stream (1)	A stream is acid in character when it contains mineral acids and/or acid salts to the extent that the total acidity determined by the hot method, using phenolphthalein indicator exceeds the total alkalinity determined to the methyl orange endpoint.

(1) This is the definition used by the Pennsylvania Sanitary Water Board, except that total alkalinity is determined to the bromphenol blue endpoint at pH 4.0.

During the 1940 study by the U. S. Public Health Service, samples with pH values below 6.0 were analyzed by both the hot and cold phenolphthalein method. On samples with pH values less than 5.1, the phenolphthalein acidity and acidity to methyl red were determined. The hot phenolphthalein test in 1940 was run in accordance with "Standard Methods for the Examination of Water and Sewage" 8th Edition - 1936. The method differs from the present hot phenolphthalein method in that the sample was brought to a boil only, whereas the present method requires boiling the sample for two minutes.

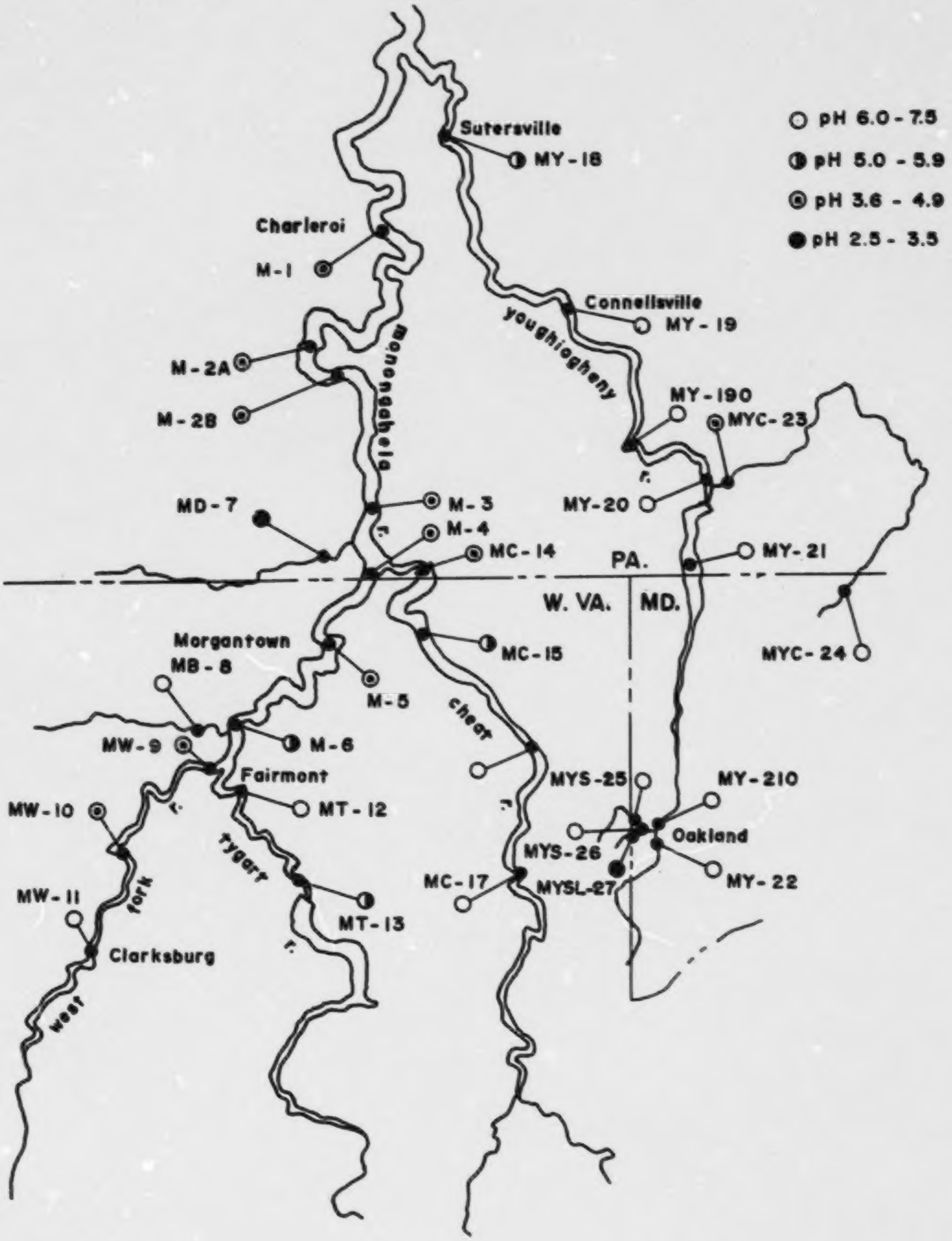
ACID CONDITIONS

As previously indicated, the studies of 1940 and 1963 include insufficient data to evaluate the acid conditions of the streams for periods other than those during which the studies were conducted.

Although pH values do not measure directly the quantity of acidity in a stream, the values may be used as an indication of the changes in acidity that occur in the stream over a period of time.

The ORSANCO Aquatic Life Advisory Committee concluded that pH values below 5.0 adversely affect aquatic life. For water treatment and other uses a desirable level would be a pH near or above the neutral level of 7.0. Results at all stations on the Monongahela during the 1963 study indicated an undesirable habitat for aquatic life with pH values less than 5.0. The Cheat River and Dunkard Creek had pH values less than 5.0. Laurel Run in the headwaters of the Youghiogheny had an average pH value of 3.5.

MONONGAHELA RIVER BASIN
pH VALUES
CHART 3


○ pH 6.0 - 7.5
◑ pH 5.0 - 5.9
⊙ pH 3.6 - 4.9
● pH 2.5 - 3.5
Sutersville
MY-18
Charleroi
M-1
Connellsville
MY-19
Youghiogheny
Monongahela
r.
M-2A
M-2B
MY-190
MYC-23
MD-7
M-3
M-4
MY-20
MC-14
MY-21
PA.
W. VA.
MD.
Morgantown
MB-8
MC-15
MYC-24
M-5
cheat
MW-9
M-6
Fairmont
MYS-25
MY-210
MW-10
MT-12
Oakland
MYS-26
tygart
MC-17
MYSL-27
MY-22
MW-11
fork
MT-13
Clarksburg
west

Monongahela River

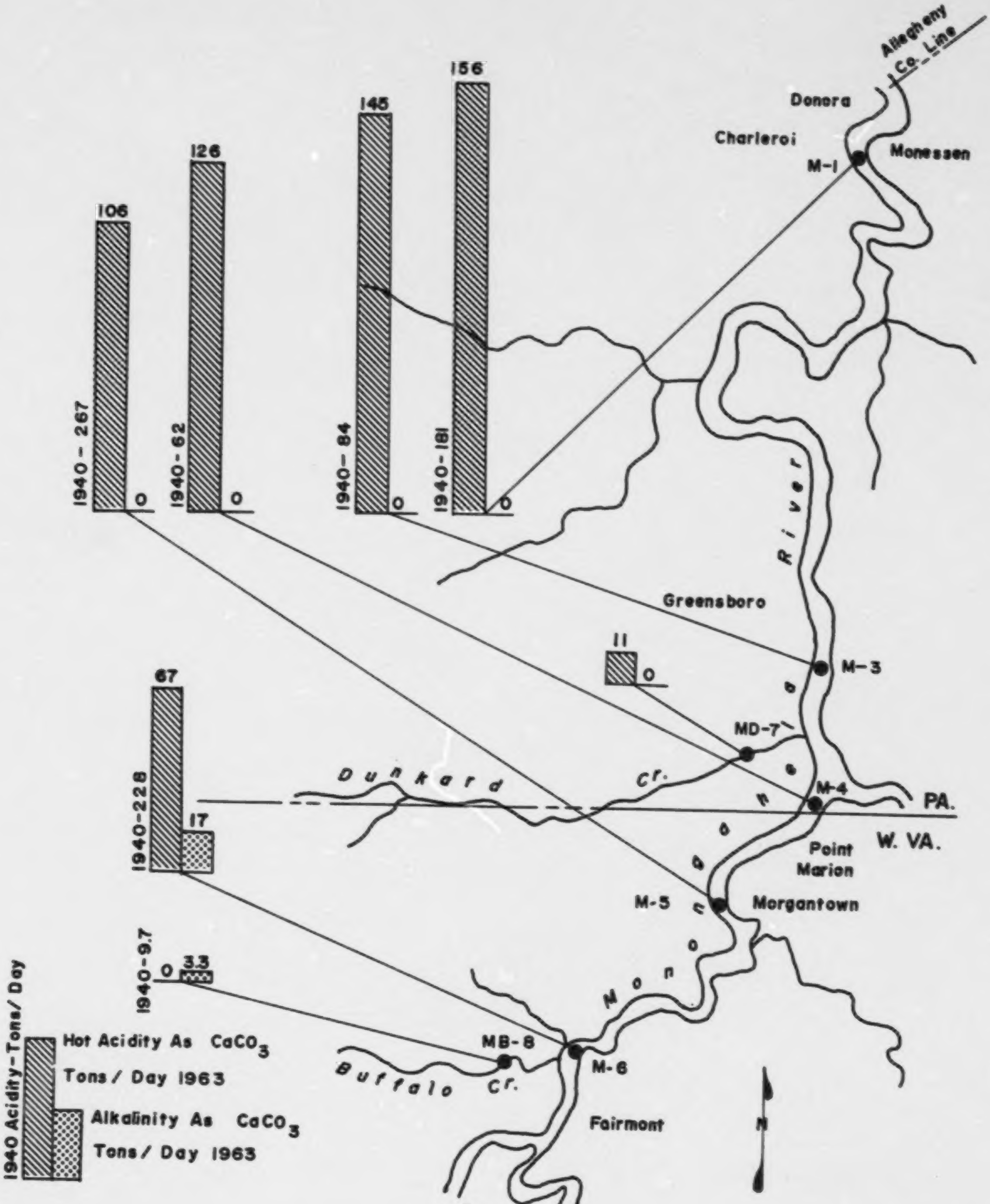
Comparison of pH values in Table 4 for the sampling points on the main stem of the Monongahela indicates that no significant change occurred from 1940 to 1963. Below Morgantown to Charleroi the 1940 pH values ranged from 3.8 to 4.1; the 1963 values had an identical range. pH values observed during the 1963 study are indicated on Chart 3. Average acid loads in tons per day are quite erratic with some values for 1963 exceeding those of 1940, and the reverse in other cases. The 1963 data show an increase in the acid load as the stream flows from Fairmont, West Virginia, 67 tons per day, to Charleroi, Pennsylvania, 156 tons per day. The data on the main stem of the Monongahela from Fairmont to Charleroi indicate that acid loads discharged to the surface waters in and upstream of this reach of the river have remained relatively the same since 1940. At Point Marion, near the State line, the river carried 126 tons of acid per day. The acid conditions of the Monongahela River damage water supplies, fixed metal structures, boats and barges, pumps and intake structures in both West Virginia and Pennsylvania.

Calculated estimates included in the 1943 Public Health Service Report indicate that at the turn of the century the Monongahela, above the confluence with the Youghiogheny, contained about 10 mg/l of alkalinity. These calculations indicate that the original natural drainage did not contribute excessive acidity to the Monongahela River.

The average acidity and alkalinity loads in the streams are indicated in tons per day for the 1963 study in Charts 4, 4A, 4B and 4C. Available 1940 data are shown to the left of the bars.

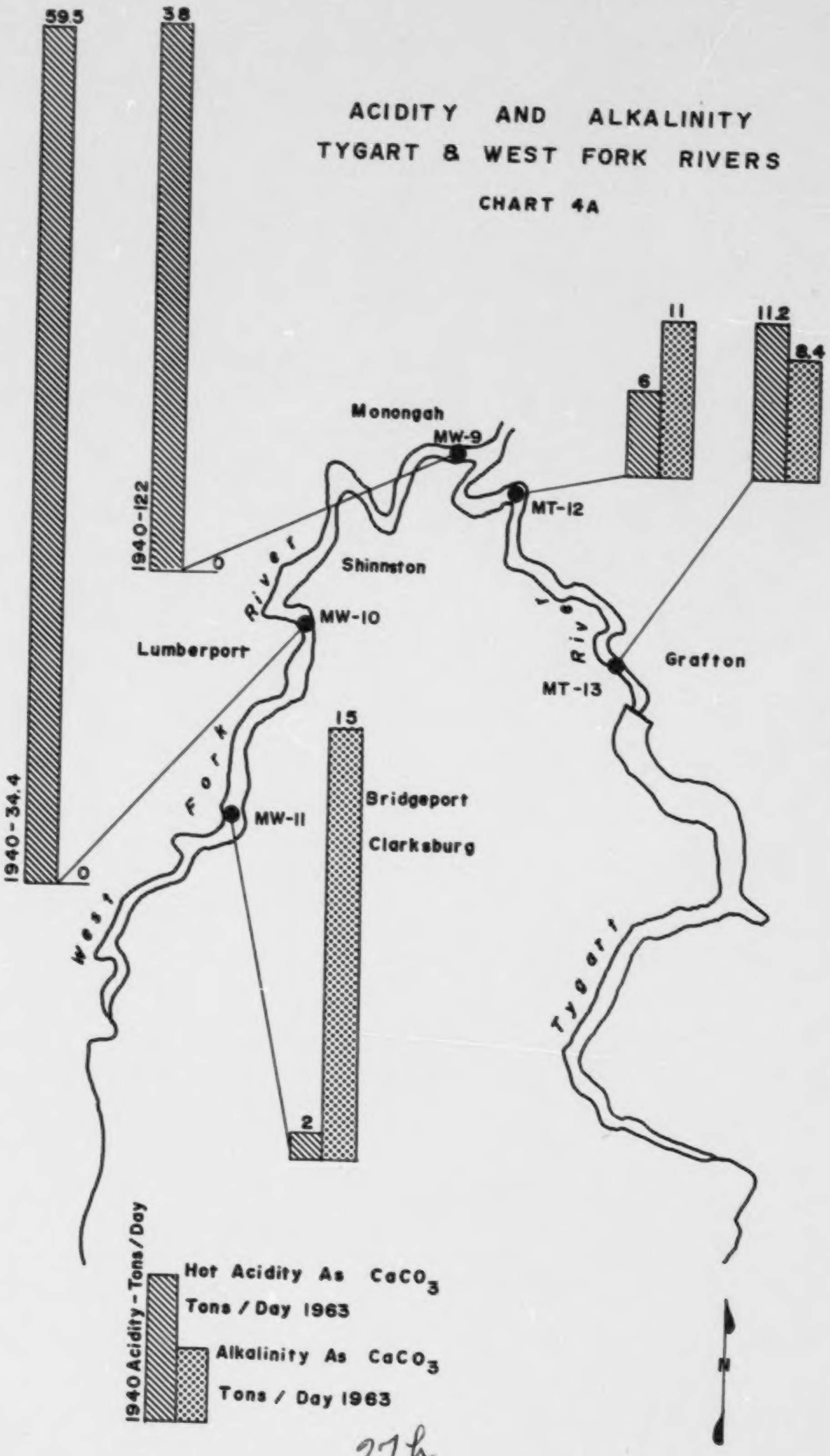
ACIDITY AND ALKALINITY
MONONGAHELA RIVER

CHART 4

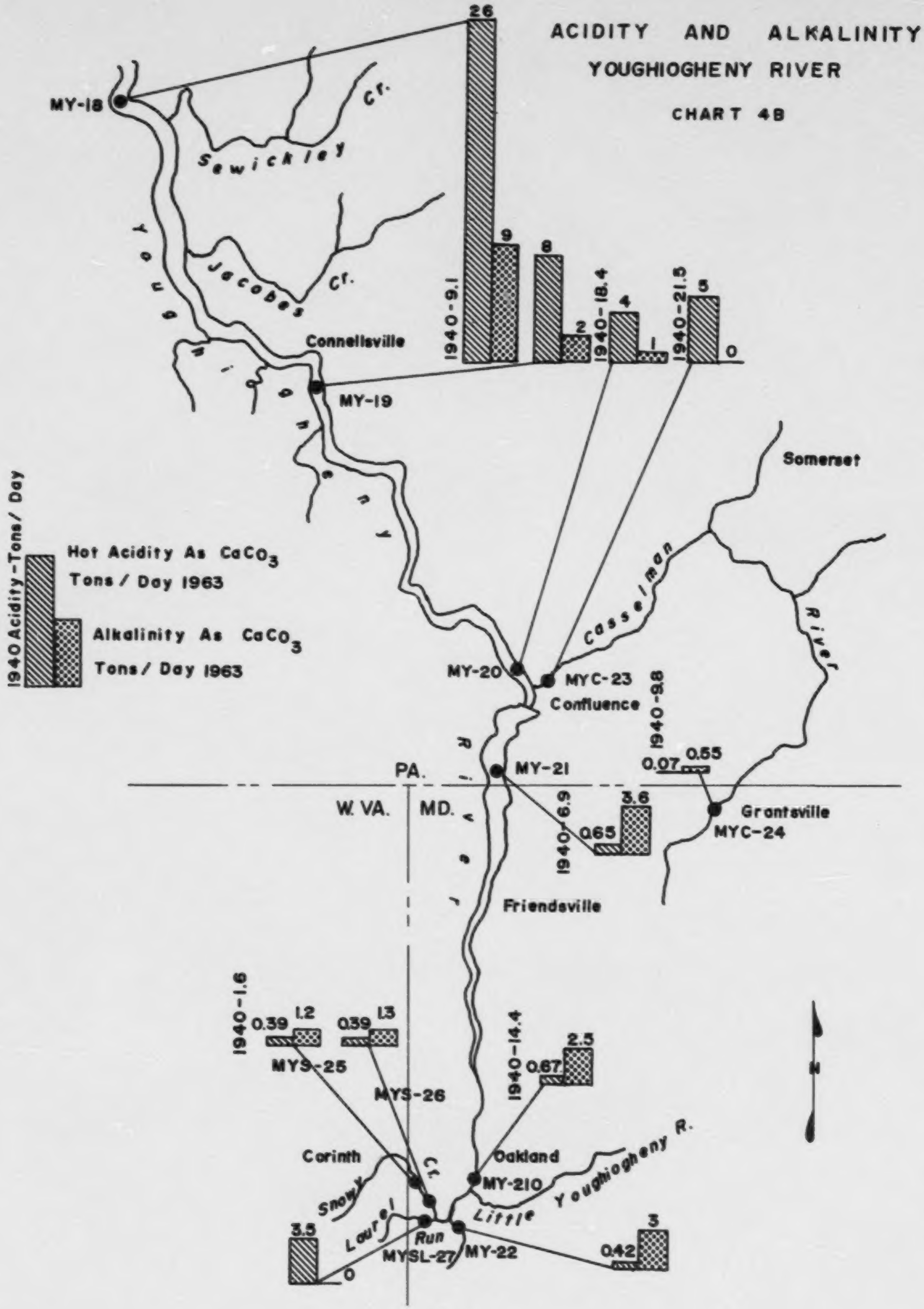

Allegheny Co. Line
Donora
Charleroi
Monessen
M-1
106
1940 - 267
0
126
1940-62
0
145
1940-84
0
156
1940-181
0
Greensboro
M-3
11
0
MD-7
67
1940-228
17
Dunkard Cr.
M-4
PA.
W. VA.
Point Marion
M-5
Morgantown
Monongahela River
1940-9.7
0
3.3
MB-8
M-6
Buffalo Cr.
Fairmont
N
1940 Acidity-Tons/Day
Hot Acidity As CaCO3 Tons/Day 1963
Alkalinity As CaCO3 Tons/Day 1963

ACIDITY AND ALKALINITY TYGART & WEST FORK RIVERS

CHART 4A

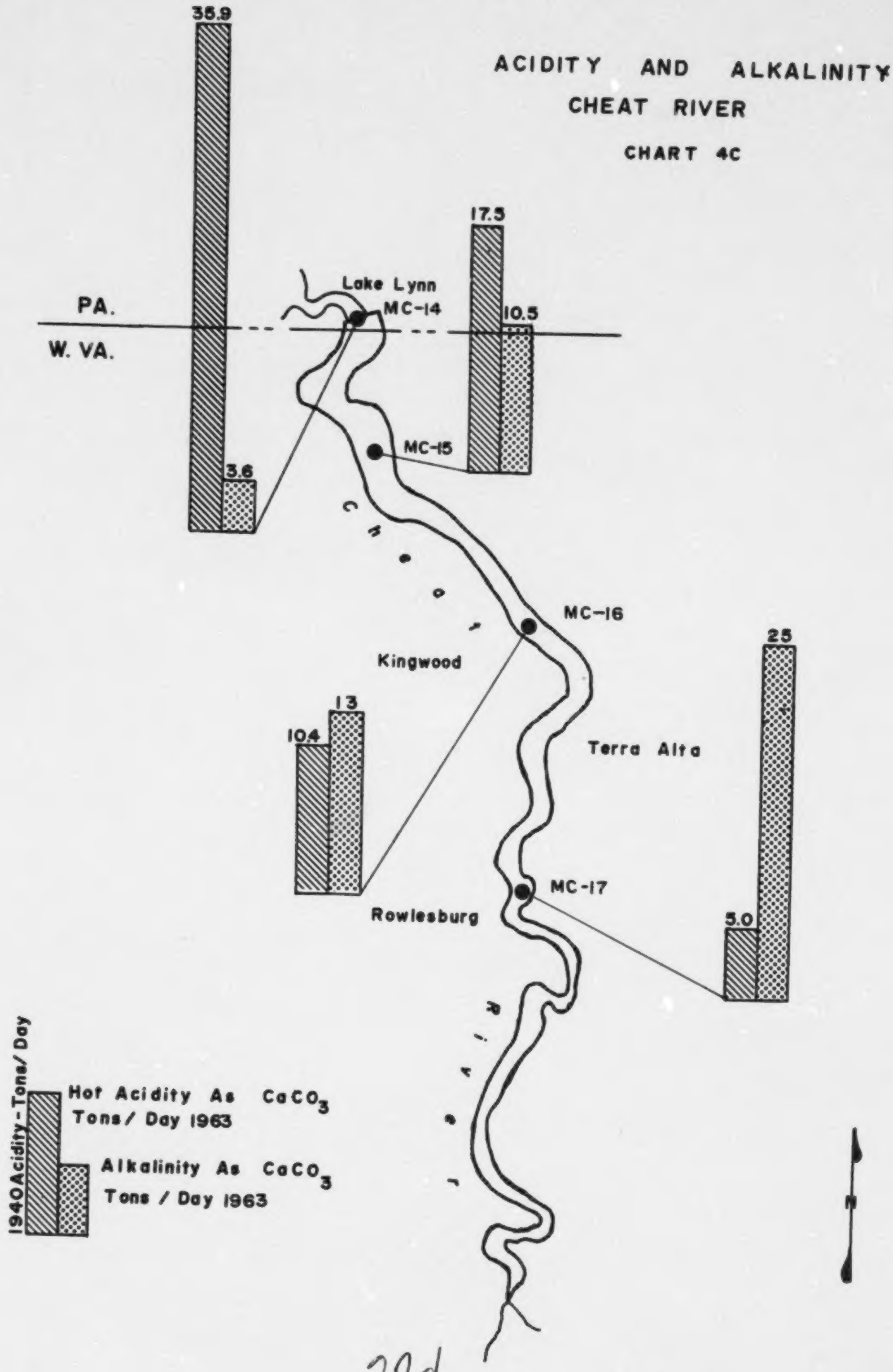

59.5
38
1940-122
0
1940-34.4
0
Monongah
MW-9
MT-12
6
11
11.2
8.4
Shinnston
River
MW-10
Lumberport
Fork
West
MW-11
15
Bridgeport
Clarksburg
2
Grafton
MT-13
River
Tygart
N
1940 Acidity - Tons / Day
Hot Acidity As $CaCO_3$
Tons / Day 1963
Alkalinity As $CaCO_3$
Tons / Day 1963

ACIDITY AND ALKALINITY
YOUGHIOGHENY RIVER
CHART 4B


26
9
8
2
4
1
5
0
1940-9.1
1940-18.4
1940-21.5
MY-18
Sewickley Cr.
Jacobes Cr.
Youghiogheny River
Connellsville
MY-19
Somerset
Casselman River
1940 Acidity-Tons/Day
Hot Acidity As $CaCO_3$ Tons/Day 1963
Alkalinity As $CaCO_3$ Tons/Day 1963
MY-20
MYC-23
Confluence
1940-9.8
0.07
0.55
MY-21
PA.
W. VA.
MD.
1940-6.9
0.65
3.6
Grantsville
MYC-24
Friendsville
1940-1.6
0.39
1.2
0.39
1.3
MYS-25
MYS-26
1940-14.4
0.67
2.5
N
Corinth
Snowy Cr.
Oakland
MY-210
Little Youghiogheny R.
Laurel Run
3.5
0
MYSL-27
MY-22
0.42
3

ACIDITY AND ALKALINITY CHEAT RIVER

CHART 4C


35.9
3.6
17.5
10.5
PA.
W. VA.
Lake Lynn
MC-14
MC-15
MC-16
MC-17
Cheat River
Kingwood
Terra Alta
Rowlesburg
10.4
13
5.0
25
1940 Acidity - Tons/ Day
Hot Acidity As $CaCO_3$ Tons/ Day 1963
Alkalinity As $CaCO_3$ Tons / Day 1963
N

West Fork River

The acid condition of the West Fork River has changed little since 1940. The problem of acid mine drainage in the West Fork River was recognized as early as 1930. During the years 1926 through 1929, hardness of the Clarksburg water supply averaged 53 mg/l in 1926 to 66 mg/l in 1929. In 1930 the average increased to 176 mg/l. During the 1963 survey the West Fork River at Clarksburg had an average hardness of 209 mg/l indicating degradation since 1930. An increase in hardness increases the cost of treating water for domestic and industrial purposes.

Tygart River

The quality of the Tygart River appears to have deteriorated from 1940 to 1963. The pH values dropped from 6.8 in 1940 to less than 6.0 in 1963. This appears to be due to increased mining activity and possibly to the neglect of maintenance of mine sealing provisions.

Cheat River

The Cheat River shows deterioration in quality during the 1940 to 1963 period. pH values in Lake Lynn dropped from 6.5 in 1940 to 5.1 in 1963, and from 6.1 to 4.5 below the reservoir. In 1940 the stream was found " . . . to be in good sanitary condition and shows little acidity". A 1929 Report of the Cheat River Basin by the West Virginia State Water Commission concludes in part " . . . the amount of toxic wastes discharged during times of low flow is too much for the amount of diluting water and that if it continues to increase it will only be a matter of time before Cheat River will be unsuitable for industry, water supply, fish life, or recreation . . . Lake Lynn is sufficiently alkaline this summer to support fish life . . ." Cheat Dam forming Lake Lynn is right at the State line. During the 1963 survey the Cheat River, with the exception of the reach in the vicinity of Rowlesburg, was found to be free of desirable aquatic life necessary to support a fish population.

Youghiogheny River

The Youghiogheny River in some sections has shown improvement in acid conditions from 1940 to 1963. The particular section studied that indicated improvement in acid loads from 1940 to 1963 extends from Oakland, Maryland to Confluence, Pennsylvania. pH values increased, and the section has changed from an acid to an alkaline stream.

The main stem of the upper Youghiogheny is interstate between West Virginia and Maryland. No known sources of pollution enter the main stem above the confluence with Snowy Creek, an interstate tributary. The pH values obtained by the Maryland Water Pollution Control Commission over a two year period show the Youghiogheny to be about neutral (pH of 7.0) upstream of Snowy Creek. The August and September, 1963 study indicated an average pH of 6.7 at this same point.

The Maryland data show a serious interstate problem between West Virginia and Maryland on the Laurel Run and Snowy Creek watersheds. This was confirmed by the findings of the 1963 survey. According to the Maryland data, Laurel Run, an interstate tributary, discharges 2,960 pounds of mineral acidity per day.* Average values obtained during the 1963 study indicate a pH of 3.5 and a load of 3.5 tons, or 7,000 pounds of total potential mineral acidity (to phenolphthalein-hot) per day being discharged by Laurel Run. Laurel Run is tributary to Snowy Creek just above the confluence of Snowy Creek with the Youghiogheny. Oakland, Maryland, uses the Youghiogheny as a source of water supply approximately 3 miles below its confluence with Snowy Creek.

The state of Maryland has requested the aid of West Virginia in cleaning up this upper section of the Youghiogheny. A proposal has been made to the West Virginia Water Resources Commission to use the Snowy Creek-Laurel Run as a " . . . pilot pollution control watershed program . . ." The 1963 session of the West Virginia legislature appropriated $20,000 for additional studies of the Snowy Creek-Laurel Run area.

The Youghiogheny is again interstate between Maryland and Pennsylvania. The State line runs through the Youghiogheny Reservoir. The Youghiogheny near the State line was alkaline. The alkalinity exceeded the acidity by 3 tons per day.

Casselman River

Casselman River, tributary to the Youghiogheny, is interstate between Maryland and Pennsylvania about 3 miles downstream of Grantsville, Maryland. The acid mine discharges to the upper reaches of the

* Maryland method for determining mineral acidity is to methyl purple endpoint. See page 25 for "Total Potential Mineral Acidity", as determined in 1963 study.

Casselman River did not detrimentally affect the condition of the river at the State line. Acid mine discharges to the Casselman in Pennsylvania causes deterioration of the stream.

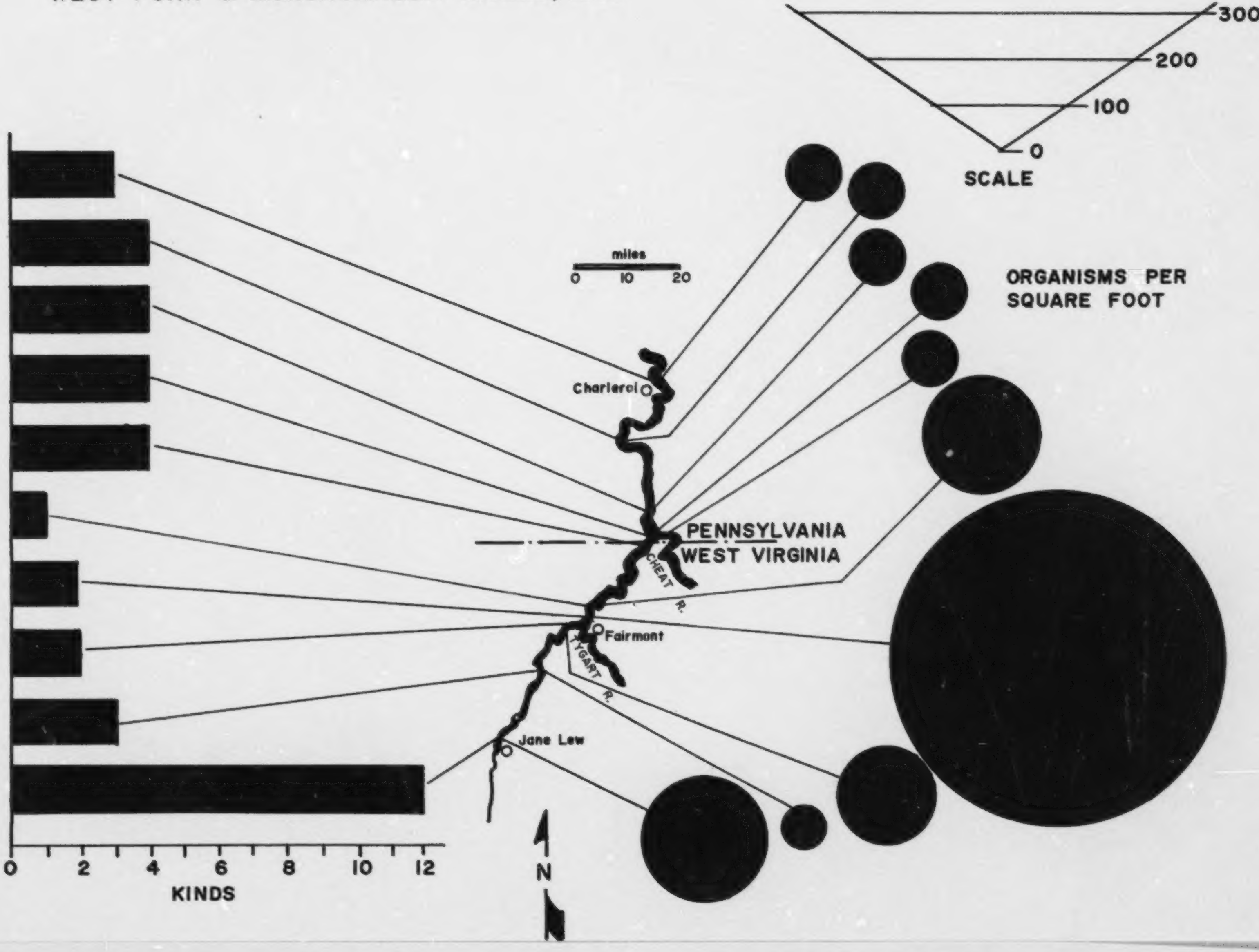
Summary of Acid Findings

Of the 27 stations used during the 1963 study, water at 17 was acid, according to the definition used for this report. All stream points examined on the Monongahela were found to be acid, as indicated on Chart 4. The Youghiogheny River was an acid stream at the three downstream stations, and alkaline at Station MY-21 near the State line. The Cheat River was acid in the lower reach as it crosses the State line. Dunkard Creek was the most acid stream studied during the survey, with 858 mg/l of acidity expressed in terms of calcium carbonate. Laurel Run was the only interstate stream that was acid in the upper reaches of the Youghiogheny during the study.

BIOLOGICAL CONDITIONS

Stations for the biological study were selected to determine the effect of pollution on the animal and plant life in the river system. During this survey, no fishermen or signs of fishing activity were observed. Fish were observed in areas not polluted with acid mine drainage, but were not observed in severely degraded areas. Fish cannot tolerate water of low pH and are most commonly found in waters having a pH range from 5 to 9. Fish spawning could not take place in most degraded areas in the Monongahela Basin. There is a lack of fish food in these degraded areas and if fish migrated into them at various times of the year, the fish would starve or move out.

CHART 5. BOTTOM ORGANISM DATA—
WEST FORK & MONONGAHELA RIVERS, 1963



Bottom organisms indicate stream conditons over a long period of time. Therefore, the biologically degraded reaches show the effects of acid discharges both at other times and during the 1963 chemical survey.

✓ Bottom Studies

The West Fork and Monongahela Rivers

Bottom samples were collected and field observations made at stations from Jane Lew below Weston, West Virginia, to the vicinity of Charleroi, Pennsylvania (Chart 5). Individual results found at each of the stations during the study are listed in Appendix B. At the first side road crossing below Jane Lew on the West Fork, many different kinds of bottom dwelling organisms were collected, indicating the suitability of the stream to support fish and other animal life. A healthy stream is denoted by many different kinds of bottom organisms, with few individuals representing each kind, principally because of the competition for food, space, and predation. The West Fork below Jane Lew is a healthy stream with a preponderance of clean water associated mayflies and caddisflies serving as fish food organisms.

Below Gypsy, West Virginia, and throughout the remainder of the stations sampled on the West Fork and Monongahela rivers, the stream was degraded by acid mine pollution. The combined effects of acidity and the deposition of sediment caused by mine drainage resulted in a drastic decrease in the kinds and numbers of bottom organisms. At Jane Lew there were 12 different kinds found in the samples; at the State line and below, there were 4 or less, showing severely degraded conditions. At Jane Lew, the bottom organisms per square foot were twice the number found at the State line. Thus, degraded stream conditions were found in the vicinity of the State line and below.

Approximately one mile above the Highway 250 bridge at Fairmont, a large flow of mine drainage entered the West Fork River. Bottom samples both above and below this area revealed few organisms and few different kinds. A core sample of the silt layer near shore indicated a base of dark grey clay, over which was deposited 1-1/2 inches of sand and fine coal, 3/4 inch of light grey silt, and, on top, 1/2 inch of yellow flocculent material. Silt covers the natural stream bottom used as living areas by bottom organisms, and decreases the kinds and numbers of organisms that can live therein. The river bottom in the stream's central portion was composed of rubble and observed to be coated with iron oxide. It was devoid of life.

Just below Fairmont, on the Monongahela River, only very tolerant sludgeworms and midges were found, and the high sludgeworm population (255 per square foot) resulted from the discharge of sewage and organic wastes from Fairmont. In Buffalo Creek and in the Monongahela River, below its confluence with Buffalo Creek, coal washing operations made the water black and covered the bottom with fine particles of coal. Bottom sediments had an odor of coal and oil. These coal fines further reduced the bottom population, since most bottom organisms could not live in the environment.

Dunkard Creek, a tributary to the Monongahela River at mile 87.1, was sampled one mile above its confluence. The bottom was covered with a three-inch layer of reddish-brown deposit, that supported many very tolerant midge larvae and little else. The stream was degraded. Much of the organic material to support the midge population was supplied by the extensive leaf litter lodged in the stream bottom; the stream is essentially covered with overhanging trees in the reach studied.

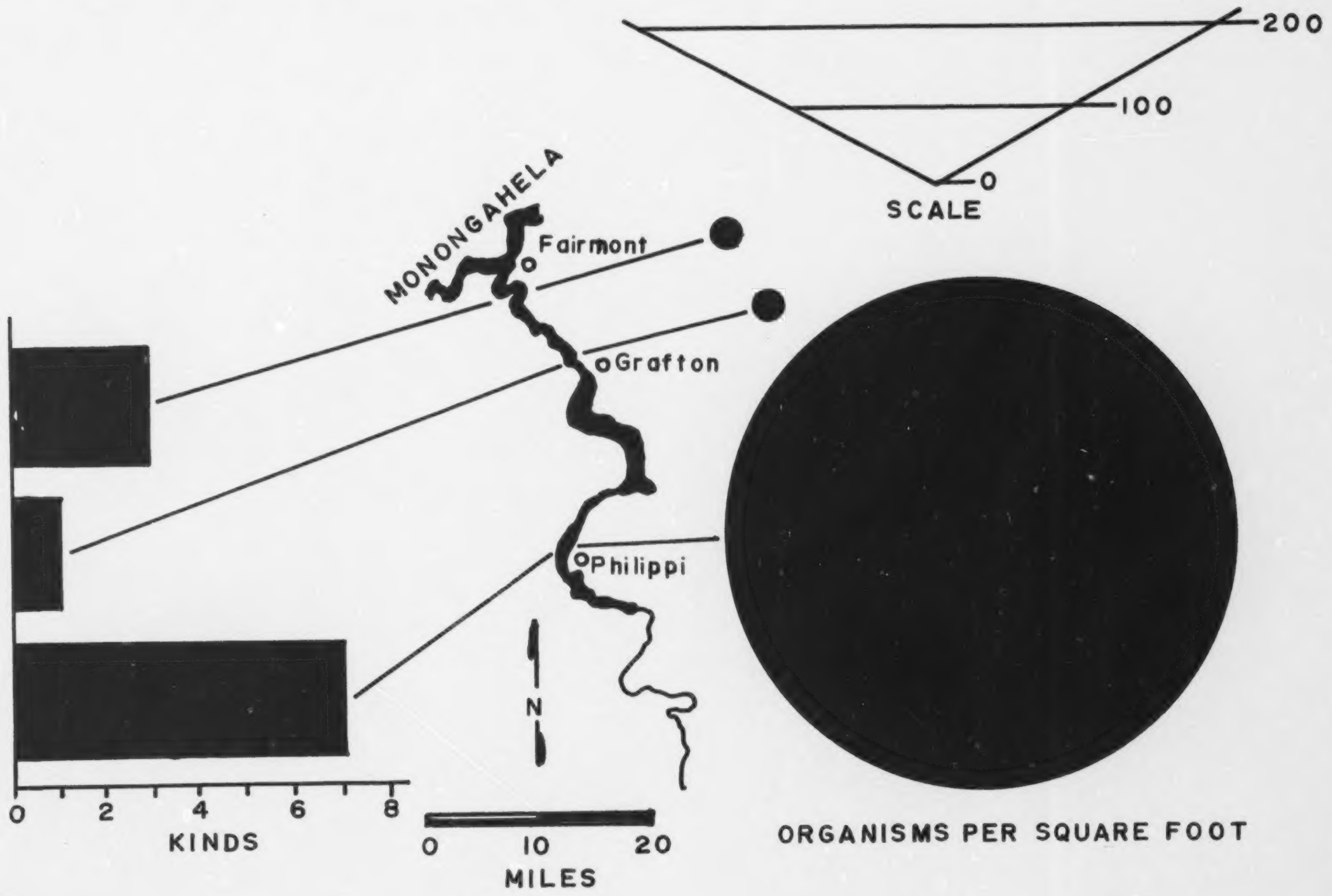
Without the sediments from acid mine drainage, the acidity and the coal fines from coal washeries, the Monongahela River would support a greater abundance of fish food organisms and a much more diversified population of bottom animals. Fish and fishing would be expected to increase proportionally to the food supply, since the fish population is directly related to available food supply.

Tygart River

The Tygart River was examined as far upstream as Norton, West Virginia, 50 miles upstream of Tygart Reservoir Dam. At this point, acid drainage that forms a substantial portion of the Tygart River flow enters the stream from the right side (facing upstream). This colors the rocks and bottom red and destroys stream life. At Belington, some recovery was indicated by the presence of such fish food organisms as a few caddisflies, hellgrammites, and midges; however, the water was extremely clear and submerged rocks supported little life.

The Middle Fork tributary at Audra, West Virginia, had a population of bottom organisms that is typical of a healthy stream, with no indication of acid pollution. The Buckhannon River tributary at Rangoon showed effects of acid mine drainage. The rocks were slick, and were covered with an iron deposit. Stream organisms were present, but not in the quantity or diversity expected for the substratum.

CHART 5A. BOTTOM ORGANISM DATA— TYGART RIVER, 1963



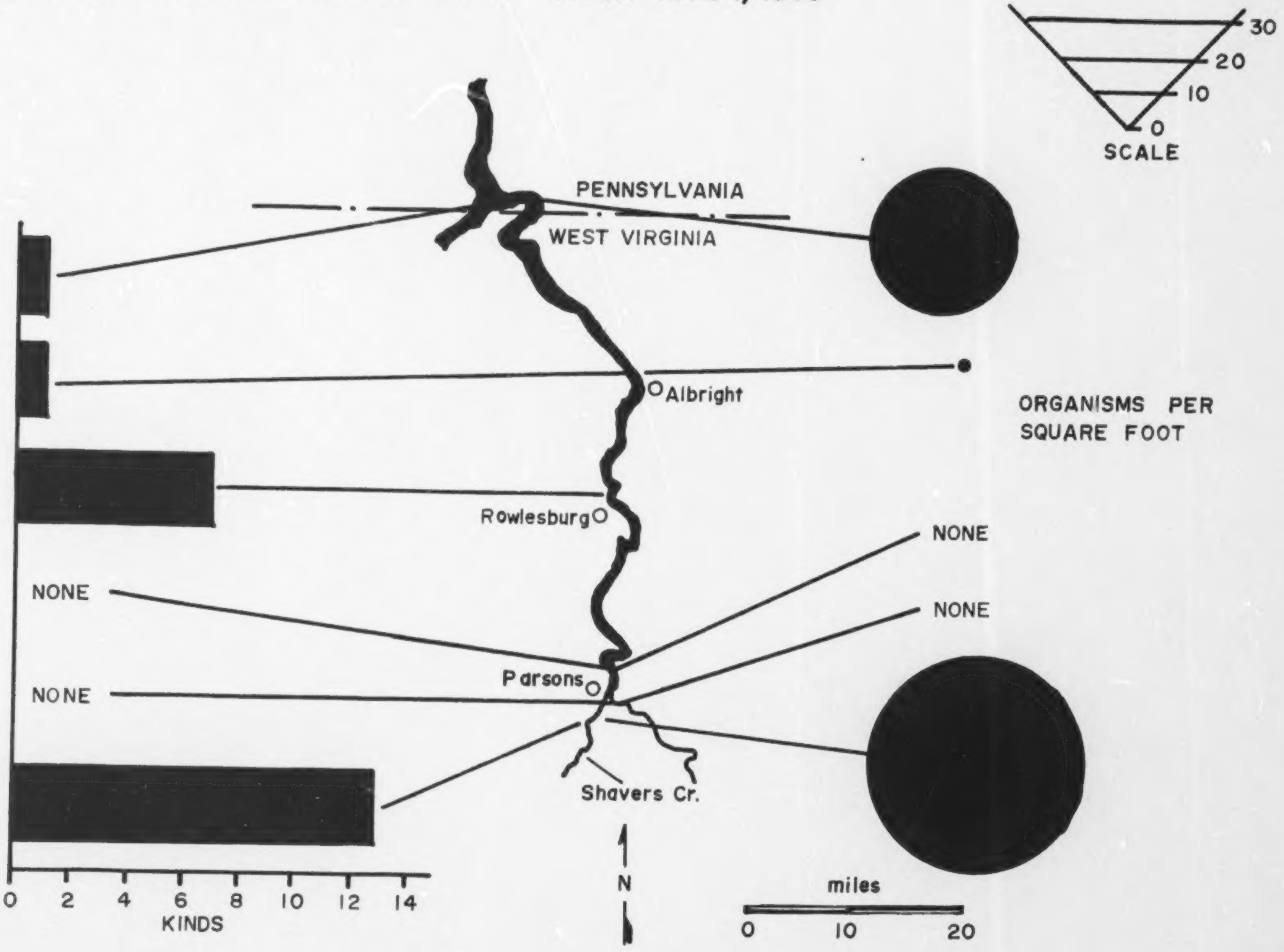
Quantitative samples (Chart 5A) were taken at Philippi, West Virginia, in a riffle area that supported 7 different kinds of organisms and a total population of 171 organisms per square foot. No mayflies were observed, and there was evidence of an iron precipitate in some areas. The area could be classed as unbalanced, but not severely degraded. Just below Philippi a large coal washing operation discharges into the river, and substantial drainage from at least 4 mines in the area pollute the stream. Downstream at Arden, West Virginia, the rocks were brownish-red and no organisms could be found.

Downstream of the Tygart River Reservoir and below Grafton, the rocks were coated with a deposit of silt and algae that sloughed off readily on contact. Oil was noted on the surface of the water. The bottom population in this riffle area was reduced to only 8 very tolerant sludgeworms per square foot, showing severe stream degradation. Little improvement was noted in the Tygart River just above its confluence with the Monongahela at Fairmont. Only 6 organisms per square foot were found, and these were represented by 3 tolerant species. These lower reaches of the Tygart River are severely polluted with acid mine drainage.

Cheat River

The Cheat River is formed by Shavers Fork and Black Water River above Parsons, West Virginia. In Shavers Fork, a total of 13 different kinds of organisms, including those normally found only in clean, healthy streams, was collected. The rocks in Black Water River, on the other hand, were coated with red silt and a tolerant algae, and contained no

CHART 5B. BOTTOM ORGANISM DATA — CHEAT RIVER, 1963



bottom organisms, indicating pollution from acid mine drainage.

Below Parsons, West Virginia, no bottom organisms were found. Some stream recovery was shown by the bottom organisms at Ro[illegible]burg (Appendix B), but at Albright severely degraded bottom [illegible] supported only an occasional organism. These conditions per[illegible] across the State line to the confluence with the Monongahela [illegible]er.

Below Lake Lynn and above its confluence with the Monongahela River, the Cheat River receives additional wastes from a coal washing operation and several acid mine discharges in Pennsylvania.

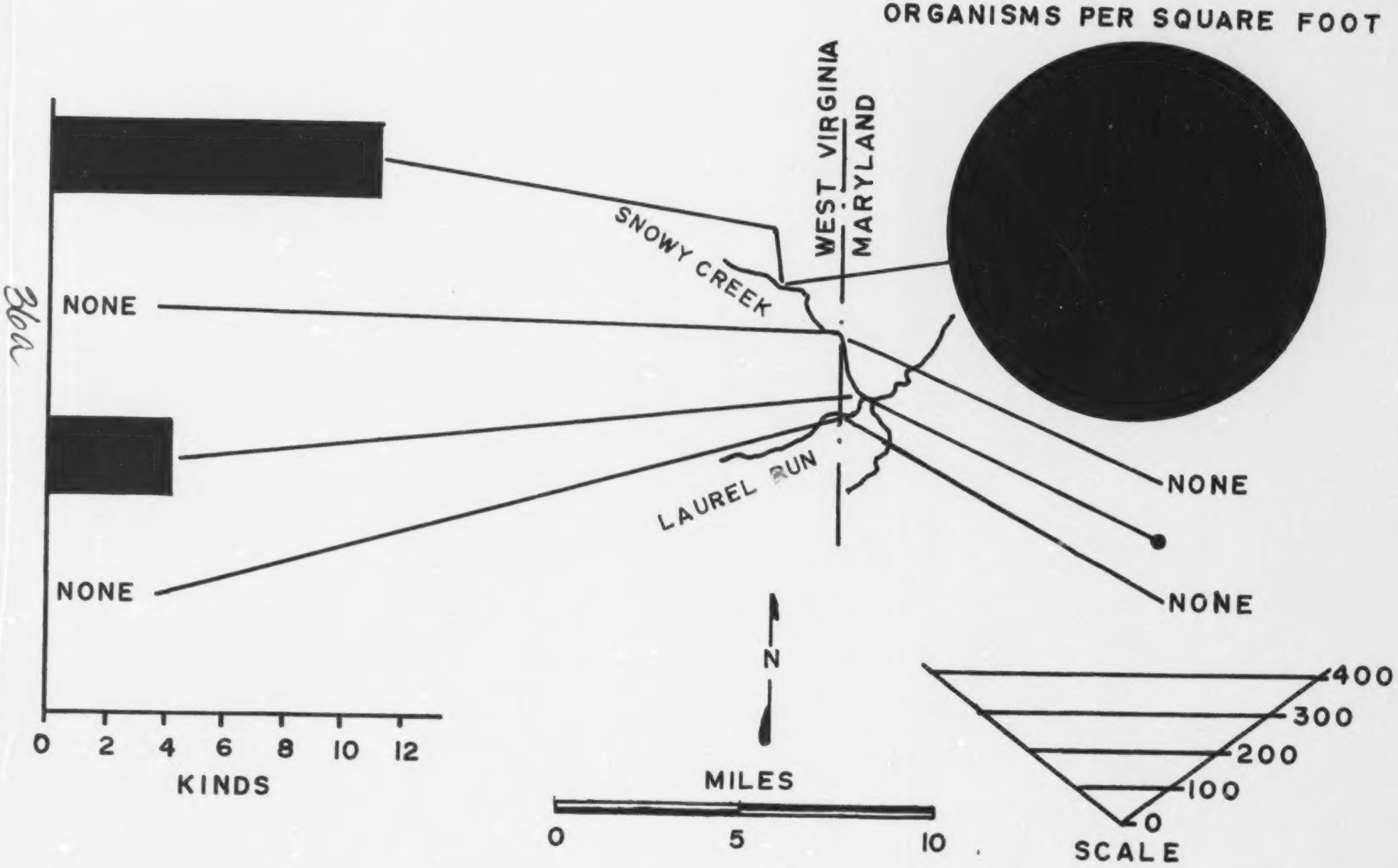
Youghiogheny River

Bottom samples from the Youghiogheny River near Oakland, Maryland, on Mansfield Road, in a riffle area, yielded 5 different kinds of organisms, including those forms normally associated with a healthy stream. Below this point, the river receives the Snowy Creek tributary.

Below the entrance of Snowy Creek, near the Oakland Bridge, 5 different kinds of organisms were found, but unlike the upstream stations, those fish food organisms normally associated with a healthy stream were either much reduced, or eliminated, and were replaced by tolerant sludgeworms and midges. Thus, an adverse effect of Snowy Creek and Laurel Run on the Youghiogheny River was demonstrated by degraded bottom conditions.

Snowy Creek (Chart 5C) below the water intake of Hopemont Sanitarium, West Virginia, in a riffle area, contained 11 different kinds of organisms and a total population of 372 organisms per square

CHART 5C. . BOTTOM ORGANISM DATA — SNOWY CREEK, 1963



foot. This represents a healthy stream and a habitat suitable for normal aquatic life. A short distance downstream just above the State line the rocks in the stream bottom were red and no bottom organisms were found either on the rocks or in the mud banks. Biological degradation in the vicinity of the State line showed that the stream was polluted with acid mine drainage. Downstream at Crellin, Maryland, only slight recovery had taken place as shown by stream organisms.

The 1963 chemical data do not show Snowy Creek to be acid during the study period. However, data provided by the State of Maryland indicate the stream becomes acid during and following periods of rainfall. The biological findings show the degraded condition of Snowy Creek caused by the acid discharges during and after rainfall.

Laurel Run, an interstate tributary of Snowy Creek, was also examined in the vicinity of Crellin, Maryland. No animal life could be found, indicating that this stream is severely degraded by acid mine drainage in the vicinity of the State line, and its usefulness is destroyed.

The Youghiogheny River at Friendsville, Maryland, was a healthy stream. A similar situation was encountered below the dam at Confluence, Pennsylvania. Seven-tenths of a mile below the junction of severely degraded Casselman River, in Pennsylvania, no bottom organisms were found and the rocks were coated with a thick gelatinous material.

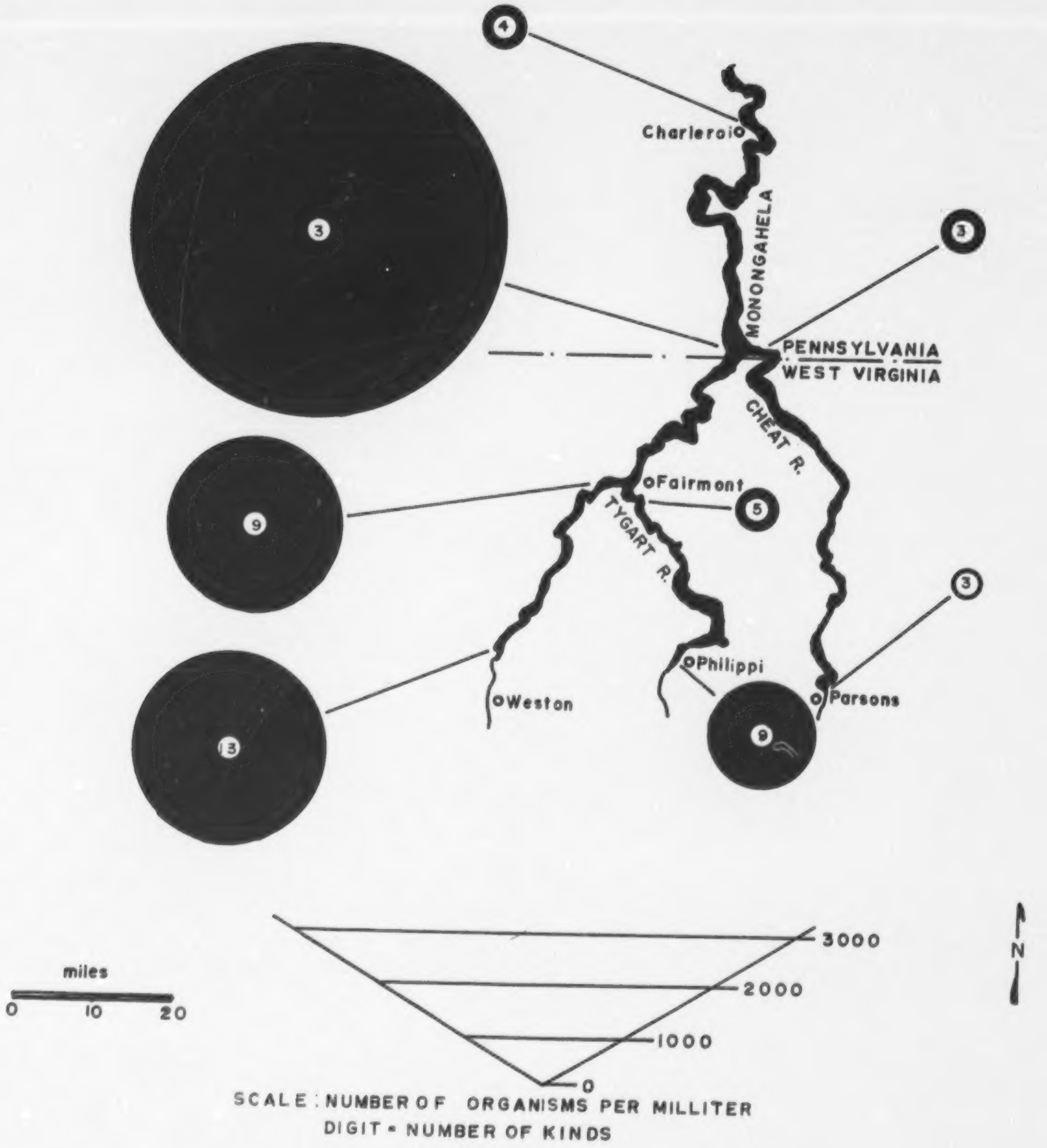
Some stream recovery occurred in the Youghiogheny River as shown by the bottom organisms at Connellsville, Pennsylvania, but above Sutersville acid mine pollution was again indicated by the absence of bottom life.

Bottom samples taken on Casselman River at Grantsville, Maryland, revealed an abundance of caddisfly larvae indicative of healthy conditions for the physical stream environment. Four-tenths of a mile below the State line in Pennsylvania, the stream receives acid mine drainage, but bottom organisms indicate recovery at the next town road crossing. At Salisbury, Pennsylvania (RM 44), bottom organisms again indicated a healthy stream. At Boynton (RM 43) and again at Meyersdale (RM 34), Pennsylvania, Casselman River receives substantial contributions of mine drainage, as shown by the absence of bottom organisms, and rocks covered with a brownish-red deposit. At Rockwood (RM 22), the rocks were red and supported no life. Just prior to its confluence with the Youghiogheny River an iron precipitate was present on the rocks, which were slick, relatively free of silt and algae, and supported no organisms.

Algal Studies

Algal counts were made at 15 locations in the Monongahela River Basin (Charts 6 and 6A). These counts confirm the findings as indicated by the bottom organisms populations. In areas polluted with acid mine drainage, the number of different kinds and the total population are substantially reduced compared to non-polluted or lesser polluted areas. Algae are an important link in the aquatic food chain furnishing food for certain bottom organisms and fish. When algae cannot develop, other aquatic organisms that might be

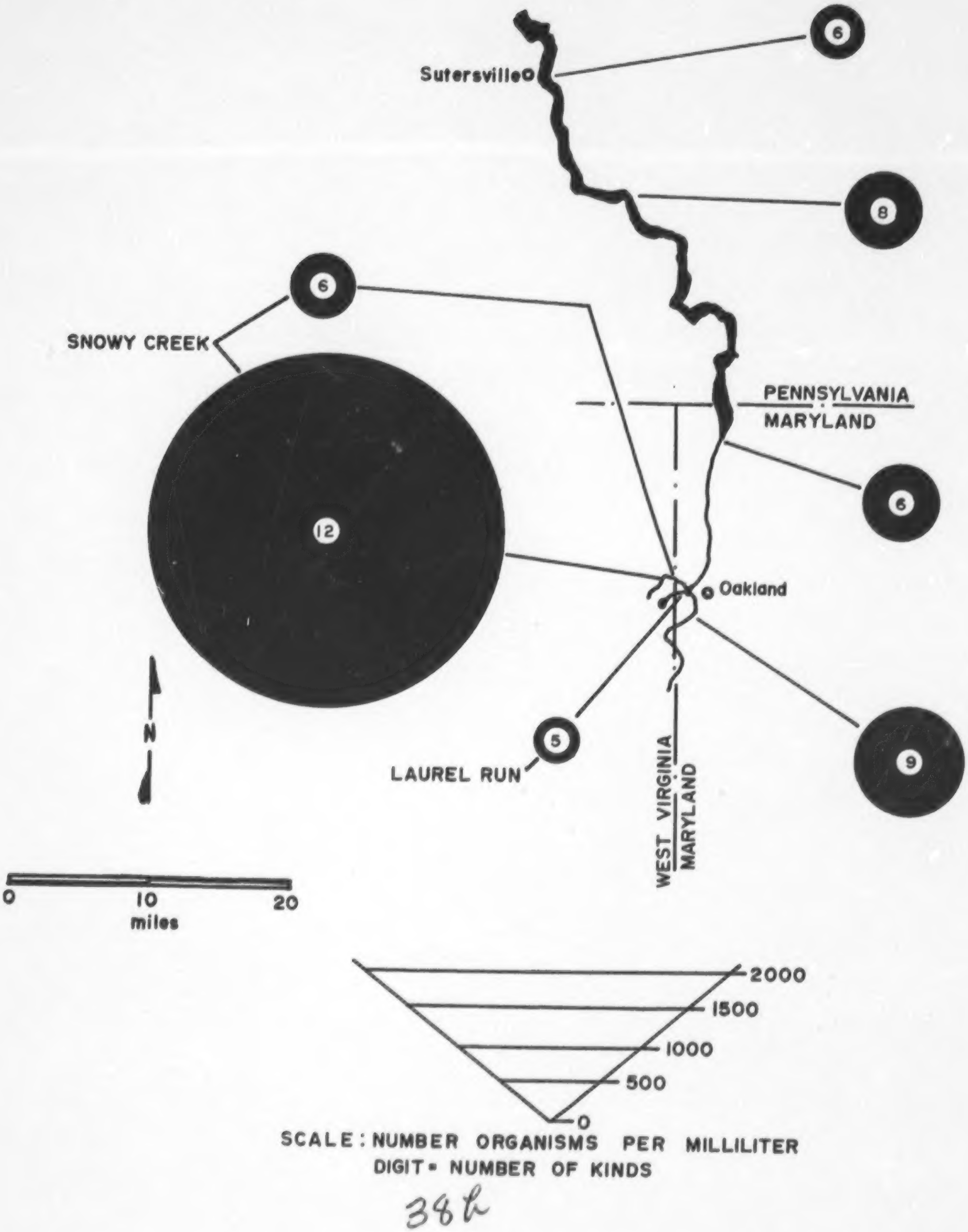
CHART 6. PLANKTON DATA — MONONGAHELA, TYGART AND CHEAT RIVERS


4
3
3
Charleroi
MONONGAHELA
PENNSYLVANIA
WEST VIRGINIA
CHEAT R.
Fairmont
9
5
TYGART R.
3
Philippi
Parsons
Weston
13
9
miles
0
10
20
3000
2000
1000
0
N

SCALE: NUMBER OF ORGANISMS PER MILLITER
DIGIT = NUMBER OF KINDS

38a

CHART 6A. . PLANKTON DATA: YOUGHIOGHENY RIVER



6
Sutersville
8
6
SNOWY CREEK
PENNSYLVANIA
MARYLAND
12
6
Oakland
5
LAUREL RUN
9
N
WEST VIRGINIA
MARYLAND
0
10
20
miles
2000
1500
1000
500
0

SCALE: NUMBER ORGANISMS PER MILLILITER
DIGIT = NUMBER OF KINDS

38h

able to tolerate local conditions are deprived of a natural food supply.

BACTERIOLOGICAL CONDITIONS

The individual results obtained by coliform and fecal streptococcus determinations are recorded in Appendix C. The membrane filter technique was used in determining both coliform and fecal streptococci densities.

The Ohio River Valley Water Sanitation Commission considers waters with an average of less than 5,000 coliform per 100 ml satisfactory for use as a raw water supply; for bathing or swimming waters, average coliform organisms should not exceed an average of 1,000 per 100 ml; and for non-bathing or non-swimming waters, the Commission's bacterial quality objective is an average of not more than 5,000 coliforms during any month of the recreational season. As member States of the Commission, Pennsylvania and West Virginia use these objectives in their pollution control programs.

Coliform and fecal streptococci densities determined on the main stem of the Monongahela during the 1963 studies generally were low and reflect the inhibiting action of the acid conditions in the stream on these pollution indicator organisms.

Coliform levels in excess of 5,000 per 100 ml were found at two points of interstate concern. The sampling station (MYS-25) on Snowy Creek at Corinth, West Virginia near the Maryland State line, had an average coliform count of 12,700 per 100 ml. The coliform count on the Casselman River at Grantsville averaged 88,700 per 100 ml.

The Youghiogheny Reservoir at the U. S. Highway 40 bridge (MY-21) just downstream of the Maryland-Pennsylvania State line had an average coliform count of 4,060 per 100 ml. This reservoir is used extensively for recreational purposes.

The December 1962 Pennsylvania Department of Health, Division of Sanitary Engineering Report to the Sanitary Water Board states that 78,800 people discharge sewage to the Monongahela between the West Virginia State line and the Allegheny County line. The Report also states "These wastes create public health hazards and nuisances at the sewer outfalls and adversely affect beneficial uses of the river."

The inhibiting effect of acid conditions on bacteria is demonstrated by an examination of the results obtained at stations MD-7, on Dunkard Creek, and at MB-8 on Buffalo Creek. Both of these streams receive sewage discharges. Dunkard Creek, just upstream of its confluence with the Monongahela, was quite acid with an average pH of 2.8. Coliform and fecal streptococci bacteria were virtually absent in Dunkard Creek. Buffalo Creek, with an average pH of 7.2, had an average coliform density of over 200,000 per 100 ml, and a fecal streptococci density of 6,500 per 100 ml.

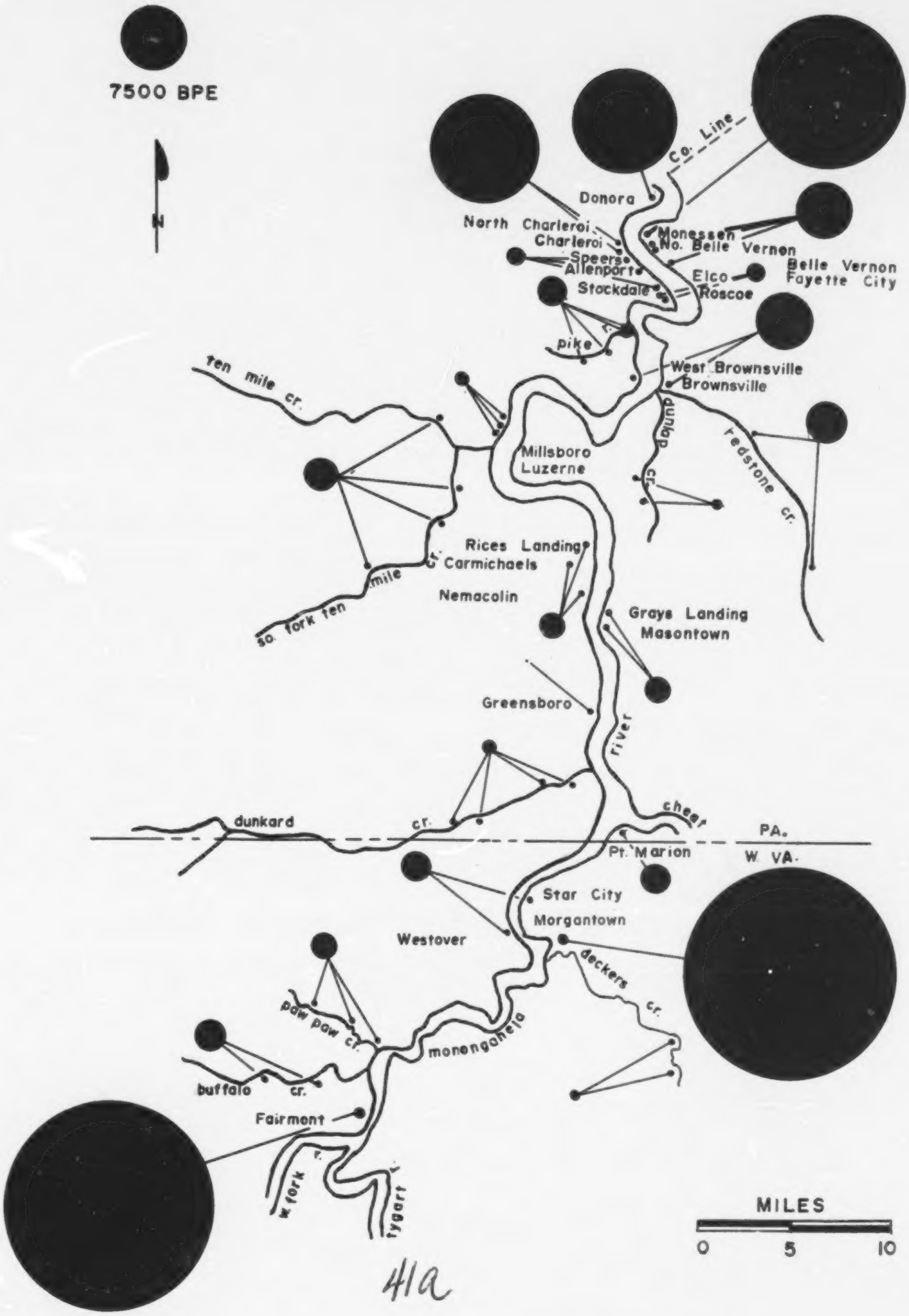
As pH values increase toward the neutral point, there is less inhibition of intestinal bacteria. At Monongah, West Virginia, on August 30 with a pH of 4.1, the coliform and fecal streptococci levels were less than 100 and less than 2 per 100 ml respectively. At this same station, on September 5, with a pH of 5.4 the bacterial densities increased to 23,000 coliform, and 50,000 streptococci per 100 ml.

Calculations of estimated coliform bacteria densities have been made on the Monongahela to determine what levels might be expected to occur when pH values are increased through a reduction of acid wastes, or acid concentrations lowered by increased stream flow. Only municipal sewage discharges were considered as sources of bacterial contamination. Charts 7, 7A, 7B, and 7C depict the sewered population discharged by each of the municipalities in the basin. With sewered population figures and stream flows available, coliform bacteria densities in non-acid streams can be estimated. The estimated values may be expected to occur should increased flow temporarily eliminate the acid conditions of the stream, or should the acid discharges be reduced at their sources.

Estimated coliform bacteria levels for the West Fork and the Monongahela Rivers are included in Appendix C. The determinations were made on the basis of a 30 percent flow (that flow that will be exceeded 70 percent of the time). These calculated estimates are indicated on Chart 8. As indicated by the chart, high coliform counts may be expected to occur at points below the sources of sewage discharge. At the State line the estimated density from all sources of upstream municipal discharges would be approximately 70,000 coliform bacteria per 100 ml, or about 47 coliforms per drop.

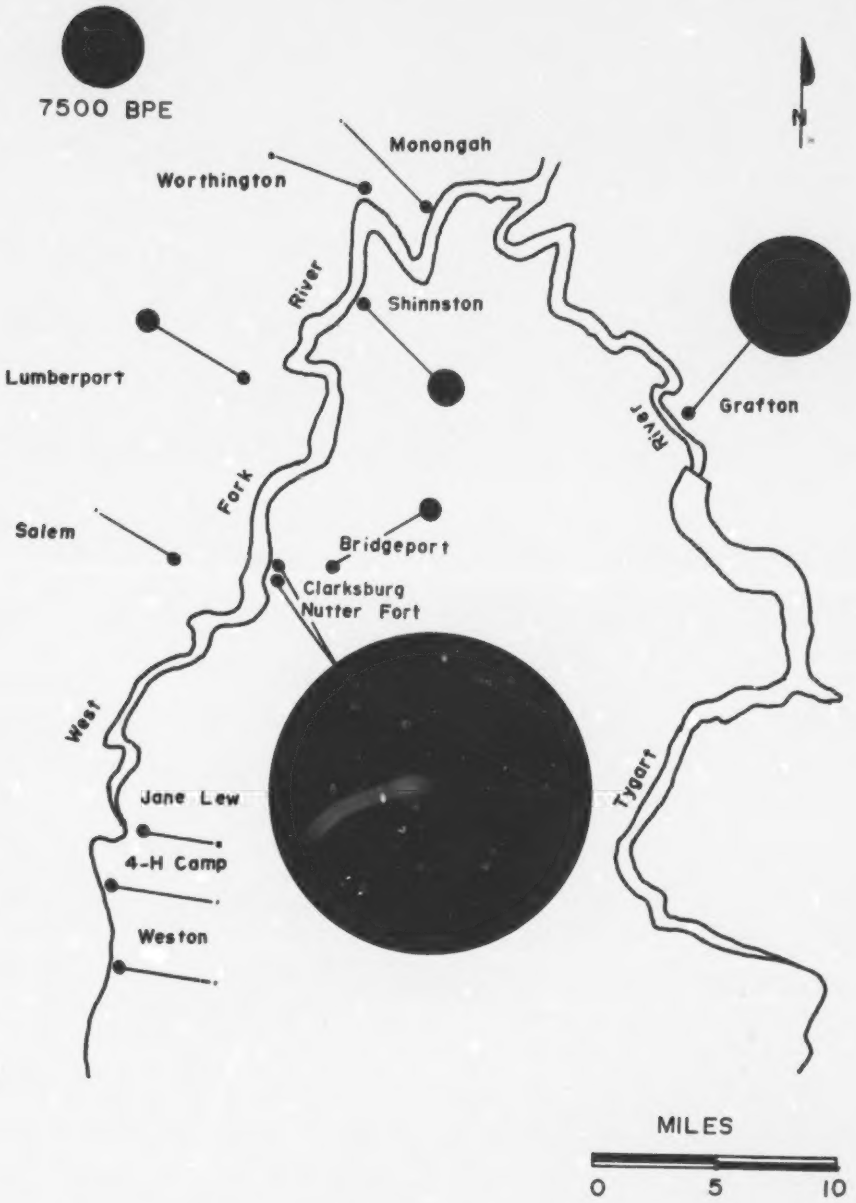
At no point between Weston and Fairmont do the calculated estimates drop below the 5,000 coliform per 100 ml, recommended maximum for use as a source of water supply. Clarksburg and Spelter withdraw water supplies from this reach. Below Clarksburg, the calculated estimate indicates a coliform level in excess of 1,650,000 per 100 ml. The coliform densities in West Virginia, as indicated by the

SOURCES OF BACTERIAL POLLUTION
MONONGAHELA RIVER
CHART 7

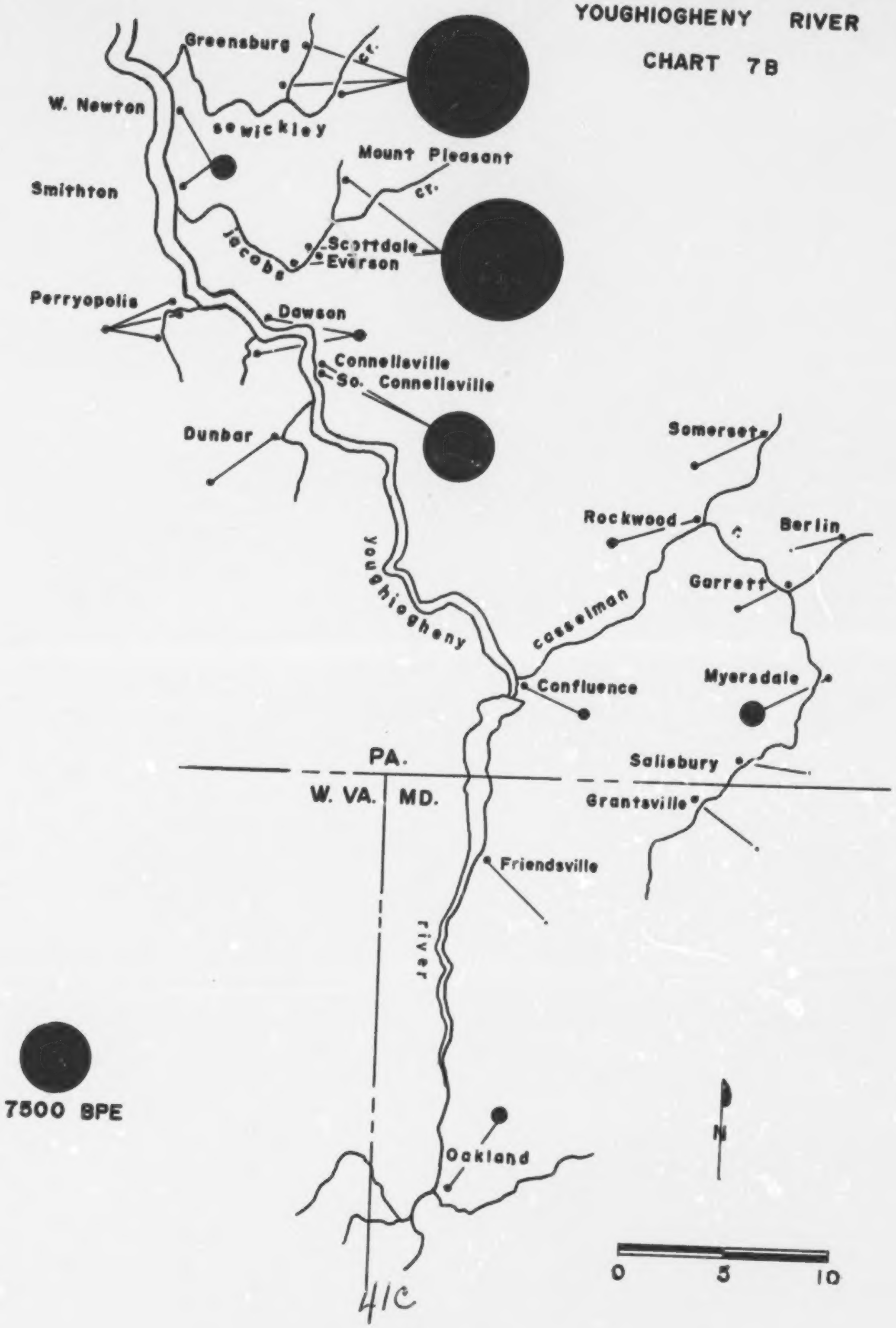


7500 BPE
N
Co. Line
Donora
North Charleroi
Charleroi
Monessen
No. Belle Vernon
Speers
Allenport
Belle Vernon
Fayette City
Elco
Roscoe
Stockdale
pike r.
West Brownsville
Brownsville
ten mile cr.
dunlap cr.
redstone cr.
Millsboro
Luzerne
Rices Landing
Carmichaels
Nemacolin
so. fork ten mile cr.
Grays Landing
Masontown
Greensboro
river
dunkard cr.
cheat r.
PA.
W. VA.
Pt. Marion
Star City
Morgantown
Westover
deckers cr.
paw paw cr.
monongahela
buffalo cr.
Fairmont
w. fork r.
tygart r.
MILES
0
5
10

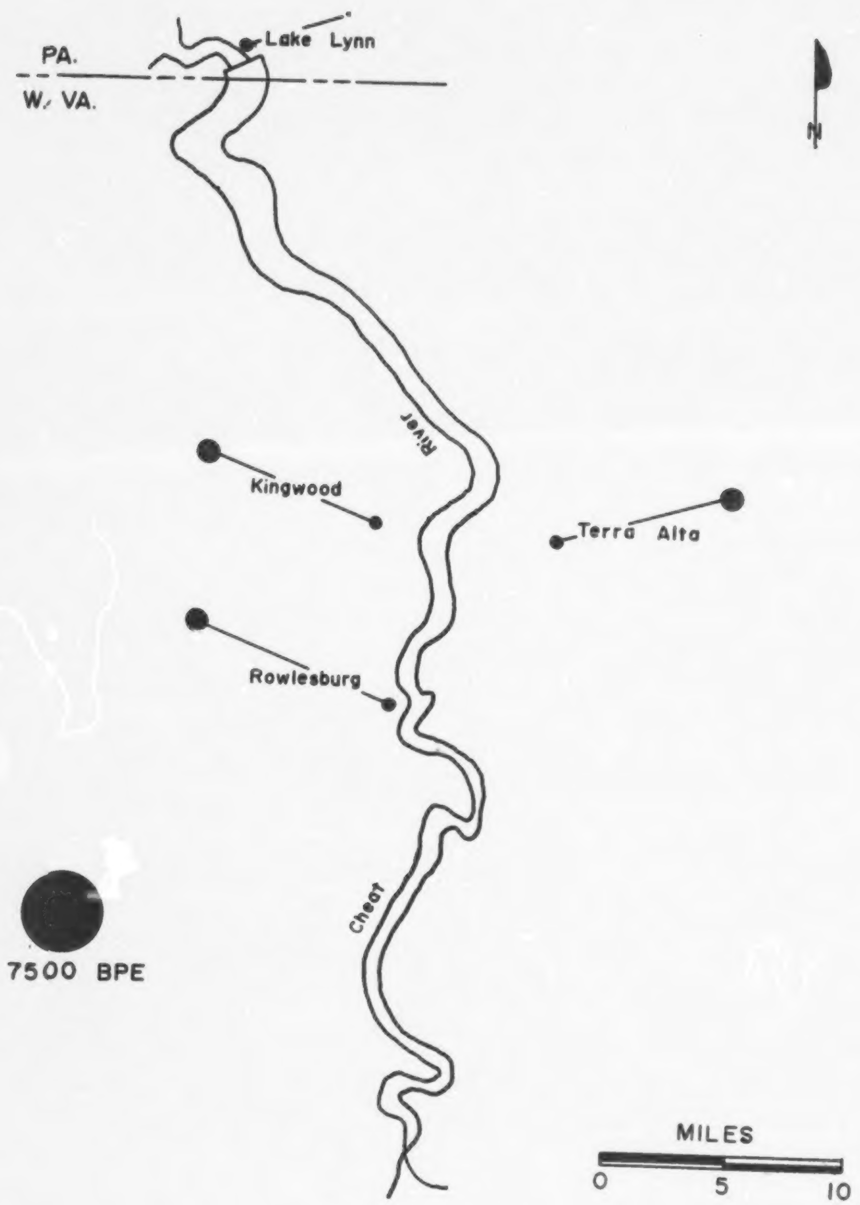
SOURCES OF BACTERIAL POLLUTION
TYGART AND WEST FORK RIVERS
CHART 7A


7500 BPE
N
Monongah
Worthington
River
Shinnston
Lumberport
Grafton
River
Fork
Salem
Bridgeport
Clarksburg
Nutter Fort
West
Tygart
Jane Lew
4-H Camp
Weston
MILES
0
5
10

SOURCES OF BACTERIAL POLLUTION
YOUGHIOGHENY RIVER
CHART 7B


Greensburg
cr.
W. Newton
sewickley
Mount Pleasant
cr.
Smithton
Jacobs
Scottdale
Everson
Perryopolis
Dawson
Connellsville
So. Connellsville
Dunbar
Somerset
Rockwood
Berlin
Garrett
youghiogheny
casselman
Confluence
Myersdale
PA.
Salisbury
W. VA.
MD.
Grantsville
Friendsville
river
7500 BPE
N
Oakland
0
5
10

SOURCES OF BACTERIAL POLLUTION
CHEAT RIVER
CHART 7C



Lake Lynn
PA.
W. VA.
N
River
Kingwood
Terra Alta
Rowlesburg
Cheat
7500 BPE
MILES
0
5
10

41d

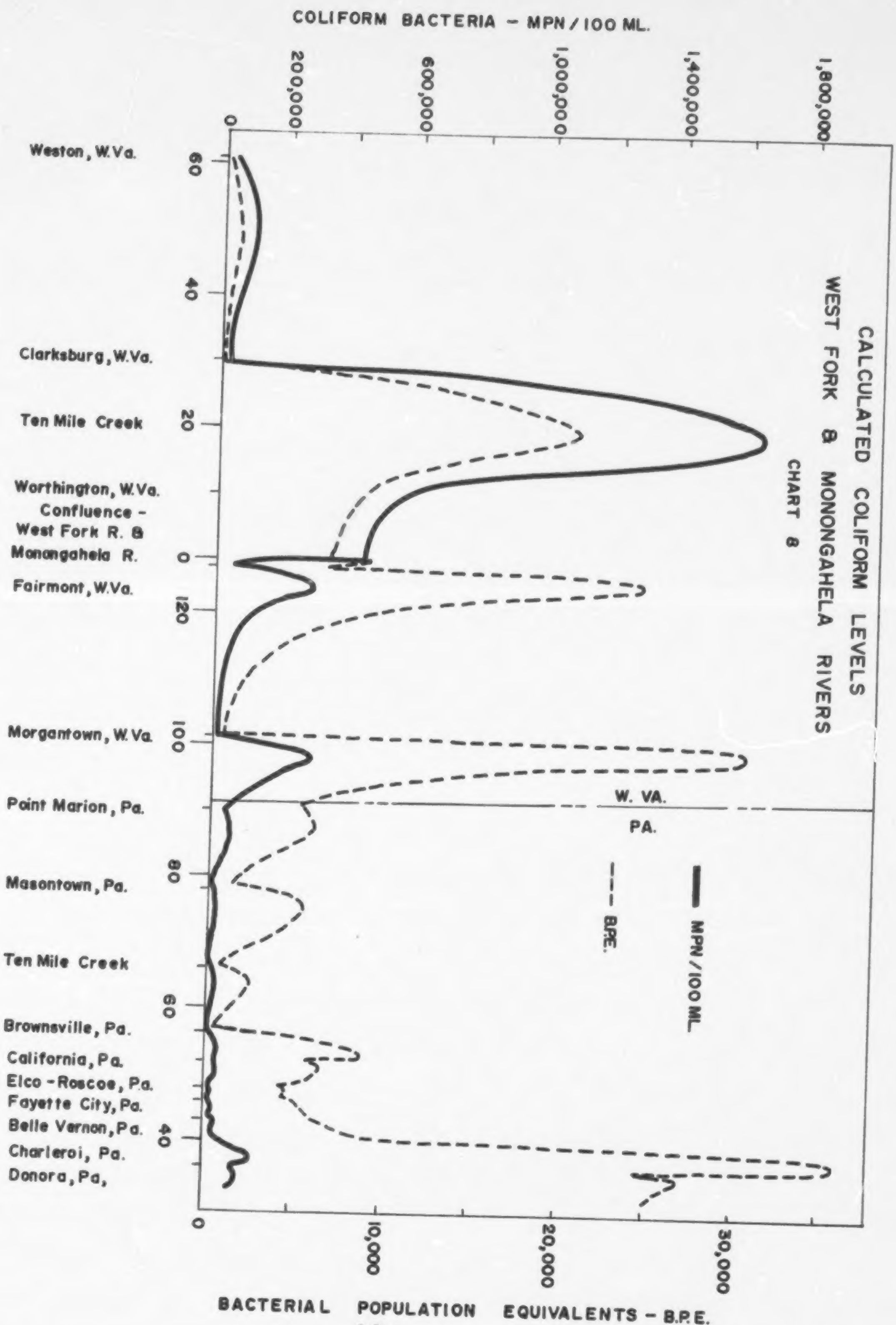
chart, range from 7,100 coliforms per 100 ml above Morgantown to the high below Clarksburg. This is from 1.4 to 350 times the recommended level for use as a source of water supply or for general recreation. The estimates range up to 1,650 times those recommended for water contact sports.

In Pennsylvania, the increased flow decreases the coliform bacteria density. Because of the large scale of Chart 8, the values in Pennsylvania appear to be low. However, densities in excess of 148,000 per 100 ml were estimated below Charleroi. Densities between the State line and the Allegheny County line at the peaks below sources of sewage vary from 10,500 to the high below Charleroi. At several points the values dropped below the 5,000 per 100 ml, but at no point did the densities drop to 1,000 per 100 ml.

Values in excess of 5,000 coliform per 100 ml present a potential health hazard to water supplies, and general recreational uses. Values in excess of 1,000 coliform per 100 ml present a health hazard where work or recreational activities require contact with or ingestion of the water. Sewage discharged to the Monongahela River by Morgantown and Westover, West Virginia, contribute to the health hazards indicated in Pennsylvania.

DISSOLVED OXYGEN (DO)

Dissolved oxygen values observed during the 1963 survey were at acceptable levels at all points on the main streams. The lowest average value on the Monongahela was 7.0 milligrams per liter (mg/l) below Fairmont. The lowest value on the main streams was 5.65 mg/l in the West Fork River at Gypsy. The DO at all stations located



CALCULATED COLIFORM LEVELS
WEST FORK & MONONGAHELA RIVERS
CHART 8

42a

near the State lines was at acceptable levels during the two week sampling period.

The 1959 Ohio River Valley Water Sanitation Commission Report includes calculated values of dissolved oxygen that would be expected to occur downstream of organic waste discharges under low flow, high temperature conditions on the West Fork and Monongahela Rivers. Low flow conditions considered were the one percent flow, or that flow that would be exceeded 99 percent of the time. Deoxygenation and reoxygenation coefficient rates found under non-acid conditions were used. The results of these calculations showed that without a high degree of treatment at Weston and Clarksburg, the dissolved oxygen in the West Fork River would be completely depleted.

The results of the calculations further indicated that with a minimum degree of treatment of all other sources of waste on the Monongahela, the dissolved oxygen levels would be maintained at acceptable levels in the reach considered in this report, assuming that the DO in the West Fork was not depleted. The Commission considers minimum treatment to be substantially complete removal of settleable solids and removal of not less than 45 percent of the total suspended solids.

MONETARY DAMAGES

The reach of the Monongahela River studied during 1963 was limited to the Allegheny County line. Sampling of the river did not extend downstream of Charleroi, Pennsylvania. When estimating damages to uses caused by the acid conditions of the stream the downstream uses must also be considered. Damages were calculated for those that occur in the Monongahela to its mouth at Pittsburgh. It is not intended to indicate that damages due to the acid contribution to the Ohio River by the Monongahela stop at Pittsburgh. The 1943 Public Health Service Report indicated damages to the extent of $2,071,000 for the year 1940 upstream of the Ohio-West Virginia-Pennsylvania State line. The Monongahela River System contributed 60 percent of the acid load above the three State lines in 1940, and contributed significantly to damages occurring in the upper reaches of the Ohio River.

The damages considered here are limited to those caused by acid mine drainage and to those that permit estimation in dollars. No effort has been made to place a value on the damages to recreation, nuisance conditions, and public health hazards that are real, and are of equal or greater significance than those listed, but are intangible.

Physical damages to those facilities for which information is presently available are the only ones considered. The losses do not include damages to intake structures and conveyance facilities, pumps, highway structures, the added expense of providing acid-resistant facilities, or the damages to mining operations.

Industrial and municipal uses of the Monongahela were obtained from data collected by a survey conducted by the Pennsylvania Department of Health, Sanitary Engineering Division, in cooperation with the U. S. Public Health Service in 1961. Calculations were based on an industrial use of 1,600 mgd requiring neutralization only and 25 mgd requiring softening. Municipal use was based on 94 mgd requiring both neutralization and softening. Data on damages to boats, barges, and lock and dam structures were obtained from the Corps of Engineers, Pittsburgh Office.

The following table lists the damages for those items that can readily be estimated.

Annual Damages Due to Acid Conditions of the Monongahela River

	Annual Damages
Industrial Water Supplies	$1,220,000
Domestic Water Supplies	154,000
Boats	354,000
Barges	483,000
Lock and Dam Structures	40,000
Total	$2,251,000

The damages not considered in the above figures in all probability equal or exceed those listed.

REFERENCES

1. "Ohio River Pollution Control", Report of the U. S. Public Health Service, House Document No. 266, 78th Congress, 1st Session, August 27, 1943.

2. "Monongahela River - Sewage Treatment Considerations", Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio, including Letter of Transmittal to the Engineering Committee, signed by Edward J. Cleary, dated January 10, 1959.

3. "Municipal Water Facilities - Inventory as of January 1, 1958", a Cooperative State-Federal Report, U. S. Department of Health, Education and Welfare, Public Health Service Publication No. 775, Volumes 2 and 3, 1960.

4. "Municipal and Industrial Waste Facilities, 1957 Inventory", a Cooperative State-Federal Report, U. S. Department of Health, Education and Welfare, Public Health Service Publication No. 622, Volumes 2 and 3, 1958.

5. "Report of the Acid Water Problem in the Snowy Creek-Laurel Run Area". Submitted to Mr. Bern Wright, Secretary, State of West Virginia, State Water Resources Commission, from John T. Johnson II, dated May 10, 1961.

6. "Report on Pollution Survey of Cheat River Basin" by Lewis V. Carpenter, Professor Sanitary Engineering, West Virginia University, and L. Kermit Herndon, Chemical Engineer, State Water Commission, to the State Water Commission - undated - but includes data for the Year 1929.

7. "A Survey of the Mine Drainage in the West Fork Basin" by L. Kermit Herndon, Chemical Engineer, State Water Commission, State of West Virginia - undated - but includes data through 1930.

8. "Report to the Sanitary Water Board on the Classification of the Main Stem of the Monongahela River" by Division of Sanitary Engineering, Bureau of Environmental Health, Pennsylvania Department of Health, Fourth Draft dated December 1962. (Final Report dated August 1963).

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9. "Observations of Coliform Bacteria in Streams" by F. W. Kittrell and Santo A. Furfari, Journ. Water Pollution Control Federation, Vol. 35, No. 11, p. 1361, November 1963.

10. "West Fork River Investigation, Benefits to Pollution Abatement and Improved Water Quality by Flow Regulations from Stonewall Jackson Reservoir, West Fork River, Monongahela River Basin, near Brownsville, West Virginia." U. S. Department of Health, Education and Welfare, Public Health Service. (Review Draft) dated August 1954, revised December 20, 1954.

11. "Report on Water Resources Study - Rowsburg Reservoir, Cheat River Basin, West Virginia and Pennsylvania, by U. S. Department of Health, Education and Welfare, Public Health Service (Review Draft) dated August 1963.

12. "Interim Report No. 1 on the Western Maryland pH Survey, June 10, 1963" by R. S. Rubelmann, Water Pollution Control Commission, Annapolis, Maryland.

13. Regulatory Actions - for the Control of Sewage, Industrial Wastes and other Substances - Ohio River Valley Water Sanitation Commission. Not dated.

APPENDIX A

INDIVIDUAL RESULTS

APPENDIX A

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	To M.O.	EDTA	micro-mhos
M-1 MONONGAHELA RIVER NEAR CHARLEROI, PA. AT LOCK 4 & RM 41.4													
Aug.	19	1:30 P	1600	24	-	3.5	8.8	39	57	13	-	284	740
	20	2:30 P	1700	23	-	3.7	8.8	36	25	5	-	261	680
	21	2:50 P	3000	24	-	4.0	9.1	25	20	3	-	196	530
	22	1:45 P	3640	24	-	4.0	8.5	23	19	8	-	208	550
	23	10:00 A	3320	24	-	4.1	9.8	22	17	3	-	200	540
	26	12:30 P	1650	24	-	4.3	8.9	18	11	1	-	112	350
	27	11:15 A	1820	23	4.5	4.1	8.8	14	14	1	-	108	355
	28	10:25 A	1850	24	3.8	4.3	9.0	16	13	1	-	119	370
	29	11:10 A	2000	24	3.8	4.1	8.8	23	19	1	-	118	365
	30	11:20 A	3000	24	3.9	4.1	8.7	19	17	4	-	128	390
Maximum				24	4.5	4.3	9.8	39	57	13	-	284	740
Minimum				23	3.8	3.5	8.5	14	11	1	-	108	350
Average			2402	24	4.0	4.0	8.9	24	21	4	-	173	487
M-2A MONONGAHELA RIVER AT MILLSBORO, PA. WATER PLANT RM 65.3													
Aug.	19	2:45 P		25	-	3.7	8.3	15	15	5	-	140	400
	20	1:30 P		24	-	4.2	8.2	18	15	2	-	123	375
	21	1:15 P		25	-	4.0	8.5	14	12	2	-	104	350
Maximum				25	-	4.2	8.5	18	15	5	-	140	400
Minimum				24	-	3.7	8.2	14	12	2	-	104	350
Average			2400(est.)	25	-	4.0	8.3	16	14	3	-	122	375

APPENDIX A

DATE 1963		Sampling Time	Flow cfs	Temp. °C	pH		D.O. mg/1	As mg/1 of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day				Field	Lab.		Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
M-3 MONONGAHELA RIVER NEAR GREENSBORO, PA. AT LOCK 7 & RM 85.0													
Aug.	19	4:00 P	1720	24	-	3.5	8.2	18	16	8	-	104	325
	20	4:25 P	1810	24	-	3.9	8.5	18	16	3	-	103	320
	21	12:10 P	4220	23	-	3.6	7.5	22	23	5	-	82	292
	22	10:35 A	3300	24	-	3.7	7.2	20	18	8	-	76	265
	23	7:50 A	3190	22	-	4.0	6.7	18	18	3	-	76	255
	26	5:30 P	1870	24	-	3.9	7.5	22	19	5	-	112	335
	27	8:50 A	1750	22	4.3	3.9	8.0	29	22	6	-	174	490
	28	1:20 P	1870	24	3.6	3.9	7.3	24	20	5	-	126	380
	29	8:50 A	2770	23	3.7	3.9	7.6	28	22	5	-	123	380
	30	9:25 A	2960	23	4.1	3.8	7.7	23	21	7	-	82	275
Maximum				24	4.3	4.0	8.5	29	23	8	-	174	490
Minimum				22	3.6	3.5	6.7	18	16	3	-	76	255
Average			2441	23	3.9	3.8	7.6	22	20	6	-	106	367

APPENDIX A

DATE								As mg/1 of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
1963		Sampling	Flow	Temp.	pH		D.O.	Hot to	Cold to	Cold to	to	EDTA	micro-
Mo.	Day	Time	cfs	°C	Field	Lab.	mg/1	Phenoth.	Phenoth.	M.O.	M.O.		mhos
M-4 MONONGAHELA RIVER NEAR PT. MARION, PA. AT LOCK 8 & RM 90.7													
Aug.	19	5:00 P	-	24	-	3.3	8.7	25	13	9.0	-	107	305
	20	9:50 A	-	24	-	3.9	8.0	26	23	6.0	-	104	345
	21	10:15 A	-	22	-	3.7	8.3	23	19	4.0	-	98	335
	22	10:20 A	-	24	-	3.7	7.6	24	20	8.0	-	158	455
	23	3:20 P	-	24	-	4.0	8.5	35	29	3.0	-	204	560
	26	11:00 A	-	23	4.2	4.2	8.5	20	16	4.0	-	145	400
	27	4:30 P	-	26	-	3.8	7.8	22	20	5.0	-	137	400
	28	7:00 A	-	21	4.6	4.1	8.2	19	24	7.0	-	127	365
	29	3:50 P	-	25	4.6	4.0	8.29	20	17	4.0	-	122	365
	30	8:20 A	-	22	4.4	3.8	7.8	22	19	7.0	-	124	380
Maximum				26	4.6	4.2	8.7	35	29	9.0	-	204	455
Minimum				21	4.2	3.3	7.6	19	13	3.0	-	98	305
Average			1940 (est.)	24	4.5	3.9	8.2	24	20	6.0	-	133	391

APPENDIX A

DATE								As mg/l of $CaCO_3$					
1963					pH			ACIDITY			ALK.	HARDNESS	
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	CONDUCT. micro-mhos
M-5 MONONGAHELA RIVER NEAR MORGANTOWN, W.VA. AT HWY. 7 BRIDGE (RM 98.0)													
Aug.	14	10:45 A	-	26	-	-	7.8	-	-	-	-	104	300
	15	10:55 A	-	22	-	-	8.0	-	-	-	-	102	285
	16	10:05 A	-	22	-	4.3	8.5	18	12	2	-	95	285
	19	6:00 P	-	24	-	4.0	9.0	10	8	2	-	102	285
	20	5:40 P	-	24	-	4.4	9.0	22	15	-	1	154	425
	21	10:00 A	-	22	-	3.8	8.1	31	23	7	-	199	540
	22	8:50 A	-	22	-	3.8	7.9	39	17	8	-	182	480
	23	5:50 A	-	22	-	4.4	8.5	16	14	-	2	138	370
	26	6:45 P	-	25	-	4.1	9.0	20	14	5	-	120	360
	27	6:50 A	-	22	4.8	4.1	7.9	15	12	1	-	115	340
	28	4:05 P	-	24	4.1	4.2	8.2	22	15	5	-	137	395
	29	6:40 A	-	22	4.2	4.2	7.7	28	17	2	-	171	465
	30	7:40 A	-	22	3.8	4.1	6.8	35	25	2	-	233	600
Maximum				26	4.8	4.4	9.0	39	25	8	2	233	600
Minimum				22	3.8	3.8	6.8	10	8	0	0	95	285
Average			1710(est.)	23	4.2	4.1	8.2	23	16	4	0	143	395

APPENDIX A

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
M-6 MONONGAHELA RIVER NEAR FAIRMONT, W.VA. AT LOCK 15 (RM 124.6)													
Aug.	14	7:30 P	2620	22	-	-	6.3	-	-	-	-	185	510
	15	9:45 A	2480	20	-	-	7.1	-	-	-	-	235	610
	16	9:50 P	1880	20	-	5.5	7.8	4	8	-	5	119	300
	19	3:50 P	939	24	-	6.2	7.1	4	6	-	3	109	280
	20	9:00 A	1190	22	-	6.2	6.9	7	5	6	6	87	238
	21	5:20 P	2560	23	-	3.9	6.7	61	49	-	-	316	800
	22	9:10 A	1530	22	-	4.9	7.1	18	16	-	2	184	445
	23	3:10 P	1170	24	-	5.1	7.0	7	11	-	5	157	380
	26	7:20 P	920	24	6.3	6.0	7.1	11	3	-	3	105	285
	27	9:40 A	869	23	-	5.9	7.2	8	5	-	5	88	240
	28	4:40 P	835	24	6.4	5.5	7.6	10	6	-	4	105	280
	29	5:10 P	-	24	5.9	6.2	6.8	10	6	-	8	102	300
	30	6:55 A	-	22	6.0	5.6	7.1	6	4	-	3	95	263
Maximum				24	6.4	6.2	7.8	61	49	6	8	316	610
Minimum				20	5.9	3.9	6.3	4	3	-	2	88	238
Average			1544	23	6.2	5.5	7.0	16	11	-	4	145	379

APPENDIX A

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY			ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.			
							MD-7 DUNKARD CREEK NEAR SHANNOPIN, PA. AT U.S.G.S. STA. 720 (RM 87.1-3.5)						
Aug.	19	4:30 P	5.1	22	-	2.8	10.2	700	660	500	-	922	3150
	20	4:45 P	4.8	23	-	2.8	9.9	710	660	365	-	912	3100
	21	11:40 A	4.8	21	-	2.8	7.7	720	660	405	-	954	3200
	22	10:00 A	4.8	21	-	2.8	8.4	730	680	385	-	1000	3250
	23	7:05 A	6.1	20	-	2.8	7.8	770	820	440	-	1028	3400
	26	5:50 P	4.4	24	-	2.7	10.5	970	820	430	-	1066	3600
	27	8:00 A	4.4	16	3.5	2.7	7.9	970	830	410	-	1058	3600
	28	3:00 P	4.1	22	3.2	2.8	10.2	1060	610	520	-	1100	3600
	29	7:55 A	5.1	21	3.0	2.7	8.2	1010	830	480	-	1104	3670
	30	8:30 A	4.4	20	3.0	2.7	8.5	940	850	470	-	1118	3630
Maximum				24	3.5	2.8	10.5	1060	850	520	-	1118	3670
Minimum				16	3.0	2.7	7.7	700	610	365	-	912	3100
Average			4.8	21	3.2	2.8	8.9	858	742	440	-	1026	3420

APPENDIX A

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY					
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
MB-8 BUFFALO CREEK NEAR BARRICKVILLE, W.VA. AT U.S.G.S. STA. 615 (RM 125.4-3.0)													
Aug.	14	8:45 P	39	20	-	-	-	-	-	-	-	254	870
	15	5:30 P	33	22	-	-	10.0	-	-	-	-	285	820
	16	5:30 P	19	22	-	7.3	11.9	0	3	-	57	205	690
	19	8:15 A	9	18	-	7.2	7.8	0	2	-	78	316	1400
	20	4:05 P	8.3	22	-	6.5	10.5	0	1	-	60	288	980
	21	5:45 P	10	24	-	6.9	11.6	0	1	-	160	296	1000
	22	8:40 A	7.8	21	-	6.9	7.3	0	8	-	162	481	2580
	23	3:45 P	7.5	24	-	7.4	12.2	0	5	-	61	330	1040
	26	9:10 A	6.0	18	7.3	7.3	7.7	0	8	-	144	468	2150
	27	9:00 A	4.0	18	-	7.4	7.8	0	5	-	82	404	1270
	28	4:15 P	3.2	23	6.6	7.5	11.7	0	3	-	75	536	1480
	29	6:00 P	-	23	6.6	7.6	9.3	0	5	-	72	400	1380
	30	6:00 A	-	20	6.6	7.4	7.1	0	4	-	75	408	1360
Maximum				24	7.3	7.6	12.2	0	8	-	162	536	2580
Minimum				18	6.6	6.5	7.3	0	1	-	57	205	690
Average			13.3	21	6.8	7.2	9.6	0	4	-	93	359	1310

APPENDIX A

MW-9

WEST FORK RIVER SOUTH OF MONONGAH, W. VA. AT RT. 250 BRIDGE (RM 128.7-4.4)

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
Aug.	19	9:10 A	156	20	-	3.6	7.7	72	55	15	-	446	1060
	20	3:10 P	528	23	-	3.9	6.8	50	37	8	-	384	920
	21	9:10 A	1340	21	-	3.9	6.7	42	27	5	-	406	900
	22	8:45 A	464	22	-	4.0	7.3	24	24	5	-	281	645
	23	4:10 P	336	24	-	4.1	7.1	21	13	2	-	274	630
	26	9:45 A	168	22	4.4	4.0	6.9	23	24	6	-	349	810
	27	8:20 P	144	24	5.0	4.9	8.2	3	0	0	1	78	205
	28	8:30 A	120	22	5.5	4.2	7.7	14	14	1	-	142	375
	29	8:30 A	-	23	4.7	4.6	7.9	10	7	0	1	92	255
	30	5:50 P	-	25	4.3	4.1	10.3	21	16	2	-	198	525
Maximum				25	5.5	4.9	10.3	72	55	15	1	446	1060
Minimum				20	4.3	3.6	6.7	3	0	0	0	78	205
Average			501*	23	4.8	4.1	7.7	28	22	4	0	265	633

* Data For 8/14 - 8/30

APPENDIX A

DATE								As mg/1 of $CaCO_3$					
1963								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
MW-10 WEST FORK RIVER NEAR GYPSY, W. VA. AT HWY. 19 BRIDGE (RM 128.7-20.0)													
Aug.	14	7:10 P	-	22	-	-	7.0	-	-	-	-	283	575
	15	4:10 P	-	22	-	-	8.0	-	-	-	-	324	675
	16	4:20 P	-	23	-	4.0	7.8	40	27	5	-	328	730
	19	9:45 A	-	20	-	3.0	7.0	112	190	42	-	485	1180
	20	2:45 P	-	22	-	4.6	5.6	22	20	0	-	384	800
	21	9:50 A	-	20	-	4.4	8.0	20	20	0	3	289	620
	22	9:30 A	-	21	-	4.2	7.0	11	15	0	1	277	590
	23	3:25 P	-	24	-	3.8	7.3	36	24	5	1	302	685
	26	10:00 A	-	20	4.3	3.5	7.0	60	52	17	-	432	1000
	27	7:30 P	-	24	3.3	3.4	7.9	126	61	1	-	480	1120
	28	9:45 A	-	20	3.4	3.4	6.8	117	71	29	-	502	1210
	29	8:45 A	-	22	3.1	3.2	7.2	133	89	40	-	532	1280
	30	5:00 P	-	24	3.6	3.2	7.4	98	85	40	-	608	1370
Maximum				24	4.3	4.6	8.0	133	190	42	3	608	1370
Minimum				20	3.1	3.0	5.6	11	15	0	0	277	575
Average			315(est.)	22	3.5	4.1	7.3	70	60	16	0	402	910

APPENDIX A

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/l	As mg/l of $CaCO_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	ACIDITY Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
							MW-11 WEST FORK RIVER NEAR CLARKSBURG, W.VA. AT U.S.G.S. GAGE 590 (RM 128.7-31.9)						
Aug.	14	6:00 P	694	22	-	-	8.0	-	-	-	-	196	385
	15	3:20 P	305	23	-	-	8.1	-	-	-	-	171	350
	16	3:30 P	162	22	-	7.5	8.7	3	2	-	30	209	410
	19	10:25 A	60	21	-	5.8	8.0	10	0	-	28	212	420
	20	2:15 P	380	22	-	6.1	8.4	4	2	-	27	220	445
	21	10:20 A	410	21	-	6.1	8.3	0	3	-	21	172	370
	22	9:55 A	230	21	-	7.0	8.4	4	2	-	17	192	395
	23	2:45 P	145	24	-	6.8	8.7	6	1	-	24	211	430
	26	11:00 A	57	22	6.4	7.0	8.4	3	3	-	16	224	440
	27	6:45 P	44	24	7.5	6.7	3.7	2	4	-	31	230	450
	28	10:20 A	35	23	7.2	7.1	8.9	1	3	-	31	229	460
	29	10:30 A	39	23	6.6	7.2	8.7	4	3	-	35	228	450
	30	4:00 P	34	25	7.1	7.1	9.2	0	1	-	33	225	440
Maximum				25	7.5	7.5	9.2	10	4	-	35	230	460
Minimum				21	6.4	5.8	3.7	0	0	-	16	171	350
Average			199.6	22	7.0	6.8	8.1	3	2	-	27	209	420

APPENDIX A

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/l	As mg/l of $CaCO_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
							MT-12 TYGART RIVER NEAR COLFAX, W.VA. AT U.S.G.S. GAGE 570 (RM 128.7-4.9)						
Aug.	14	9:45 A	1690	20	-	-	8.2	-	-	-	-	42	103
	15	9:30 A	1540	20	-	-	9.0	-	-	-	-	42	108
	16	9:25 A	1490	20	-	7.5	8.5	0	0	-	-	39	102
	19	3:20 A	886	24	-	4.8	8.5	2	4	-	4	38	98
	20	9:20 A	970	21	-	5.2	8.6	4	1	-	5	39	102
	21	4:40 P	1130	24	-	5.5	8.4	4	1	-	4	54	136
	22	4:20 P	935	25	-	6.4	8.3	2	2	-	4	45	114
	23	8:45 A	830	22	-	6.6	8.4	3	1	-	3	42	110
	26	8:00 P	865	24	6.0	6.6	8.2	3	1	-	3	39	102
	27	6:55 A	351	20	6.8	6.3	8.5	3	1	-	4	41	106
	28	5:30 P	844	24	7.4	6.2	8.4	3	1	-	4	41	104
	29	8:00 A	-	22	5.9	5.6	8.0	2	3	-	4	40	102
	30	8:00 A	-	22	5.9	5.4	8.6	3	2	-	3	40	104
Maximum				25	7.4	7.5	9.0	4	4	-	5	54	136
Minimum				20	5.9	5.2	8.0	0	0	-	3	38	98
Average			1094	22	6.4	6.0	8.4	2	2	-	4	42	107

APPENDIX A

MT-13

TYGART RIVER NEAR GRAFTON, W.VA. AT HWY. 50 BRIDGE (RM 128.7-18.6)

DATE 1963								As mg/1 of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M. O.	to M.O.	EDTA	micro-mhos
Aug.	14	11:35 A	-	20	-	-	9.0	-	-	-	-	46	118
	15	10:30 A	-	21	-	-	9.2	-	-	-	-	38	96
	16	10:10 A	-	20	-	5.6	9.0	4	3	-	2	37	96
	19	11:30 A	-	22	-	4.8	-	2	5	-	2	40	102
	20	1:10 P	-	22	-	5.2	8.8	4	3	-	4	45	116
	21	11:05 A	-	22	-	5.8	8.6	2	2	-	4	46	117
	22	10:45 A	-	22	-	5.7	8.6	2	3	-	3	42	106
	23	1:55 P	-	22	-	7.6	9.0	3	1	-	2	40	104
	26	12:00 N	-	22	5.9	5.9	8.8	3	1	-	3	41	105
	27	5:55 P	-	24	7.0	6.0	9.2	3	3	-	3	40	102
	28	11:20 A	-	23	7.5	6.0	8.6	6	1	-	4	41	104
	29	11:15 A	-	22	5.7	5.6	8.3	5	3	-	4	44	116
	30	3:00 P	-	25	5.3	4.9	8.9	8	7	-	3	50	133
Maximum				24	7.5	7.6	9.2	8	7	-	4	50	133
Minimum				20	5.3	4.9	8.2	2	1	-	2	37	96
Average			1040(est)	22	6.3	5.7	8.8	4	3	-	3	42	109

APPENDIX A

DATE								As mg/1 of $CaCO_3$					
1963					pH			ACIDITY			ALK.	HARDNESS	
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth	Cold to M.O.	to M.O.	EDTA	CONDUCT. micro-mhos
MC-14 CHEAT RIVER AT CHEAT DAM (RM 89.4-3.5)													
Aug.	19	10:00 A	-	22	-	4.0	7.3	10	10	2	0	42	131
	20	10:15 A	-	23	-	4.0	6.2	20	19	3	0	52	182
	21	10:45 A	-	23	-	5.1	8.2	9	8	0	5	45	135
	22	11:10 A	-	24	-	4.3	9.9	10	9	0	1	46	134
	23	2:55 P	-	25	-	4.9	8.8	9	7	0	1	44	130
	26	11:30 A	-	23	4.8	4.4	7.0	8	7	0	1	44	128
	27	4:00 P	-	25	-	4.6	7.1	8	7	0	2	44	121
	28	7:40 A	-	23	4.6	4.4	7.2	8	8	0	1	44	124
	29	3:20 P	-	25	5.1	4.5	8.4	9	6	0	1	44	125
	30	9:10 A	-	24	4.5	4.4	8.4	8	7	0	1	44	126
Maximum				25	5.1	5.1	9.9	20	19	3	5	52	182
Minimum				22	4.5	4.0	6.2	8	6	0	0	42	121
Average			1330(est)	24	4.8	4.5	7.9	10	9	0	1	45	134

APPENDIX A

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/1	As mg/1 of $CaCo_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	ACIDITY Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
MC-15 CHEAT RIVER AT HWY. 73 BRIDGE (CHEAT LAKE) RM 89.4-9.3													
Aug.	14	12:00 N	-	24	-	-	6.8	-	-	-	-	39	98
	15	11:30 A	-	23	-	-	7.2	-	-	-	-	38	92
	16	10:55 A	-	24	-	5.0	6.6	4	7	-	5	39	100
	19	9:25 A	-	22	-	4.4	7.2	4	3	-	1	42	109
	20	3:25 P	-	24	-	4.6	7.4	6	6	-	2	42	118
	21	4:20 P	-	26	-	4.9	7.8	6	5	-	5	42	120
	22	4:30 P	-	26	-	4.3	7.3	10	8	-	1	47	133
	23	9:15 A	-	24	-	5.1	7.5	7	6	-	2	43	119
	26	6:00 P	-	24	6.6	6.1	7.0	2	3	-	3	36	90
	27	10:45 A	-	24	-	4.8	6.9	7	5	-	2	41	114
	28	2:45 P	-	24	5.7	5.6	6.8	3	4	-	3	37	93
	29	7:10 A	-	22	6.2	5.3	6.7	6	3	-	2	39	102
	30	3:50 P	-	25	6.0	5.6	7.3	4	2	-	2	40	98
Maximum				26	6.6	6.1	7.8	10	8	0	5	47	133
Minimum				22	5.7	4.3	6.6	2	2	0	1	36	92
Average			1300(est)	24	6.1	5.1	7.1	5	5	0	3	40	106

APPENDIX A

DATE 1963		Sampling Time	Flow cfs	Temp. °C	pH		D.O. mg/1	As mg/1 of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day				Field	Lab.		Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
							MC-16 CHEAT RIVER NEAR ALBRIGHT AT HWY. 26 BRIDGE (RM 89.4-27.7)						
Aug.	14	5:20 P	-	21	-	-	8.5	-	-	-	-	34	85
	15	5:40 P	-	22	-	-	8.7	-	-	-	-	34	83
	16	3:00 P	-	26	-	6.5	8.2	0	5	-	2	32	81
	19	6:00 P	-	32	-	4.2	7.4	8	5	2	0	40	110
	20	10:40 A	-	26	-	4.4	7.9	9	10	-	1	48	143
	21	3:20 P	-	26	-	5.9	8.3	1	3	-	10	33	85
	22	3:00 P	-	30	-	6.2	8.0	2	2	-	4	34	86
	23	10:05 A	-	23	-	6.4	8.2	2	1	-	8	30	74
	26	5:35 P	-	28	6.8	7.1	8.2	2	1	-	10	31	75
	27	3:40 P	-	30	7.3	6.6	8.1	3	1	-	5	34	85
	28	1:30 P	-	29	7.2	6.5	7.8	3	1	-	5	33	80
	29	1:30 P	-	24	6.4	6.1	7.8	7	3	-	5	43	101
	30	10:00 A	-	24	6.1	5.9	8.3	5	4	-	5	37	94
Maximum				30	7.3	7.1	8.7	9	10	2	10	48	143
Minimum				21	6.1	4.2	7.4	0	1	0	0	30	74
Average			960 (est)	26	6.8	6.1	8.1	4	3	0	5	36	91

APPENDIX A

DATE 1963 Mo.	 Day	Sampling Time	Flow cfs	Temp. °C	pH Field	 Lab.	D.O. mg/1	As mg/1 of CaCO$_3$ ACIDITY Hot to Phenoth.	 Cold to Phenoth.	 Cold to M.O.	 ALK. to M.O.	 HARDNESS EDTA	CONDUCT. micro-mhos
MC-17 CHEAT RIVER NEAR ROWLESBURG, W.VA. AT U.S.G.S. GAGE 700 (R.R.BRIDGE) RM 89.4-45.0													
Aug.	14	1:15 P	1320	20	-	-	8.0	-	-	-	-	28	64
	15	12:30 P	930	19	-	-	9.0	-	-	-	-	28	66
	16	11:20 A	620	18	-	7.0	8.6	0	4	-	8	24	59
	19	1:25 P	340	23	-	6.9	8.5	1	2	-	6	32	82
	20	11:30 A	820	20	-	6.5	8.6	1	1	-	9	27	66
	21	12:10 P	1070	21	-	6.3	8.5	2	1	-	12	29	72
	22	11:55 A	1280	22	-	6.2	8.5	1	2	-	10	24	60
	23	12:55 P	1460	22	-	6.8	8.2	2	1	-	10	24	55
	26	1:55 P	740	22	6.4	7.2	8.7	3	1	-	8	0	69
	27	4:45 P	500	24	7.7	7.3	8.4	3	1	-	9	28	66
	28	12:30 P	410	23	7.5	6.8	8.4	2	1	-	14	30	68
	29	12:45 P	685	22	6.5	6.6	7.5	5	2	-	13	32	76
	30	2:00 P	1700	21	6.8	6.6	8.8	3	1	-	10	26	66
Maximum				24	7.7	7.3	9.0	5	4	-	14	32	88
Minimum				18	6.4	6.2	7.5	0	1	-	6	24	60
Average			913	21	7.0	6.7	8.4	2	2	-	10	28	67

APPENDIX A

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/1	As mg/1 of $CaCO_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	ACIDITY Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
							MY-18 YOUGHIOGHENY RIVER NEAR SUTERSVILLE, PA. AT U.S.G.S. GAGE 835 (RM 15.6-12.4)						
Aug.	19	11:00 A	870	20	-	4.3	8.5	12	15	-	0	86	275
	20	1:15 P	880	21	-	5.3	8.6	9	11	-	3	85	267
	21	4:00 P	880	24	-	5.6	8.9	12	11	-	7	76	240
	22	2:45 P	850	24	-	5.5	8.6	12	11	-	5	78	250
	23	11:15 A	885	22	-	6.5	8.2	10	12	-	3	83	270
	26	3:15 P	796	22	-	5.1	9.1	12	11	-	3	95	290
	27	12:40 P	805	22	5.7	5.6	8.8	12	12	-	3	91	290
	28	9:15 A	850	20	5.2	5.9	8.1	10	13	-	5	86	275
	29	2:20 P	890	24	5.2	5.6	8.6	10	4	-	3	72	220
	30	12:20 P	900	22	5.4	5.6	8.4	10	11	-	3	76	237
Maximum				24	5.7	6.5	9.1	12	15	-	7	95	290
Minimum				20	5.2	4.3	8.1	9	4	-	0	72	220
Average			859	22	5.4	5.5	8.6	11	11	-	4	84	261

APPENDIX A

MY-19
YOUGHIOGHENY RIVER IN CONNELLSVILLE, PA. AT CRAWFORD AVE. BRIDGE (RM 15.6-44.4)

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/1	As mg/1 of $CaCO_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	ACIDITY Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
Aug.	19	11:15 A	807	17	-	5.0	-	2	2	-	9	33	95
	20	11:10 A	851	18	-	5.8	9.2	2	2	-	5	35	88
	21	12:00 N	785	20	-	8.0	9.3	1	2	-	7	38	94
	22	12:15 P	829	21	-	6.8	8.8	2	1	-	5	40	100
	23	1:50 P	818	22	-	7.9	9.3	2	1	-	2	49	120
	26	1:10 P	720	18	7.6	6.6	9.5	3	2	-	4	38	97
	27	2:45 P	796	20	-	6.7	9.4	2	1	-	7	35	88
	28	9:10 A	785	18	5.6	6.3	9.0	4	1	-	6	31	79
	29	1:25 P	829	24	6.4	6.5	8.8	4	3	-	7	30	77
	30	10:25 A	851	20	6.1	6.2	9.0	1	1	-	5	32	81
Maximum				24	7.6	8.0	9.5	4	3	-	9	49	120
Minimum				17	5.6	5.0	8.8	1	1	-	2	30	77
Average			802	20	6.4	6.6	9.1	2	2	-	5	37	92

APPENDIX A

DATE							As mg/l of $CaCO_3$					
1963					pH			ACIDITY		ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos

MY-20
YOUGHIOGHENY RIVER AT HWY. 281 BRIDGE IN PA. (RM 15.6-68.9)

Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/l	Acidity Hot to Phenoth.	Acidity Cold to Phenoth.	Acidity Cold to M.O.	Alk. to M.O.	Hardness EDTA	Conduct. micro-mhos
Aug.	19	2:10 P	788	17	-	5.6	9.5	2	3	-	5	20	54
	20	12:45 P	764	16	-	5.8	9.4	1	4	-	6	21	55
	21	2:00 P	764	17	-	7.0	9.6	1	1	-	10	21	56
	22	1:40 P	796	17	-	5.9	9.3	3	1	-	7	22	55
	23	11:45 A	788	17	-	7.6	9.4	2	1	-	7	22	56
	26	2:40 P	740	18	7.2	6.7	9.1	2	2	-	6	22	55
	27	1:15 P	788	18	-	6.6	9.1	3	1	-	7	22	57
	28	11:10 A	780	18	5.8	6.4	9.1	3	3	-	9	22	56
	29	11:20 A	788	18	6.0	6.3	9.0	3	2	-	8	23	57
	30	12:25 P	804	18	6.5	6.3	9.2	3	2	-	8	22	56
Maximum				18	7.2	7.6	9.6	3	4	-	10	23	57
Minimum				16	5.8	5.6	9.0	1	1		5	20	54
Average			772	17	6.4	6.4	9.3	2	2	-	7	22	56

APPENDIX A

DATE 1963								As mg/l of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M. O.	to M.O.	EDTA	micro-mhos
MY-21 YOUGHIOGHENY RESERVOIR AT HWY. 40 BRIDGE IN PA. (RM 15.6-76.6)													
Aug.	19	4:00 P	-	24	-	5.3	8.1	1	2	-	8	22	57
	20	2:35 P	-	23	-	5.8	8.0	2	1	-	8	20	56
	21	3:30 P	-	24	-	5.8	8.4	3	1	-	8	21	56
	22	3:30 P	-	24	-	6.8	8.5	3	1	-	8	22	56
	23	10:10 A	-	23	-	7.3	8.3	2	1	-	7	21	55
	26	5:05 P	-	24	7.6	6.8	8.2	2	1	-	7	20	56
	27	11:30 A	-	23	-	6.8	8.4	3	1	-	6	21	56
	28	1:45 P	-	24	6.6	6.6	8.5	2	1	-	7	22	55
	29	8:35 A	-	22	6.8	6.3	8.4	4	2	-	12	21	56
	30	2:35 P	-	23	6.4	6.5	8.8	2	1	-	6	21	55
Maximum				24	7.6	7.3	8.8	4	2	-	12	22	57
Minimum				22	6.4	5.3	8.1	1	1	-	6	20	55
Average			121(est)	23	6.9	6.4	8.4	2	1	-	8	21	56

APPENDIX A

DATE 1963 Mo.	Day	Sampling Time	Flow cfs	Temp. °C	pH Field	pH Lab.	D.O. mg/1	As mg/1 of $CaCO_3$ ACIDITY Hot to Phenoth.	ACIDITY Cold to Phenoth.	ACIDITY Cold to M.O.	ALK. to M.O.	HARDNESS EDTA	CONDUCT. micro-mhos
MY-210 YOUGHIOGHENY RIVER NEAR OAKLAND, MD. (RM 15.6-111.9)													
Aug.	14	2:40 P	-	18	-	-	8.2	-	-	-	-	32	72
	15	3:40 P	-	18	-	-	8.0	-	-	-	-	32	85
	16	12:30 P	-	18	-	7.0	8.1	0	5	-	12	32	86
	21	1:05 P	-	19	-	6.0	7.7	1	3	-	5	30	81
	22	12:50 P	-	20	-	6.6	7.7	2	2	-	14	30	83
	23	11:45 A	-	19	-	6.7	7.8	1	2	-	10	31	80
	26	3:05 P	-	20	6.4	6.8	8.1	2	1	-	9	38	92
	27	1:15 P	-	20	7.2	6.8	7.8	4	1	-	11	39	108
	28	3:20 P	-	21	7.3	6.5	7.7	2	3	-	12	42	116
	29	2:50 P	-	18	6.5	6.9	6.2	12	8	-	18	47	227
	30	11:00 A	-	17	6.6	6.3	7.5	5	3	-	12	28	83
Maximum				21	7.3	7.0	8.2	12	8	-	18	47	227
Minimum				17	6.4	6.0	6.2	0	1	-	5	30	72
Average			83 (est)	19	6.8	6.6	7.7	3	3	-	11	34	106

APPENDIX A

DATE								As mg/1 of $CaCO_3$					
1963					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/1	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
MY-22 YOUGHIOGHENY RIVER NEAR OAKLAND, MD. AT SILVER KNOB RD. (RM 15.6-119.5)*													
Aug.	13	-	-	18	-	-	7.3	-	-	-	-	33	58
	14	4:05 P	-	16	-	-	7.8	-	-	-	-	24	55
	15	4:10 P	-	16	-	-	9.4	-	-	-	-	24	53
	16	1:55 P	-	20	-	6.8	9.2	0	3	-	16	22	56
	20	3:20 P	-	16	-	6.8	-	3	3	-	13	24	59
	21	2:10 P	-	18	-	5.8	8.0	2	2	-	16	22	51
	22	1:45 P	-	18	-	6.0	8.6	0	1	-	15	20	48
	23	11:00 A	-	16	-	7.3	8.6	2	2	-	9	22	49
	26	4:30 P	-	18	6.5	7.3	9.9	1	1	-	7	23	52
	27	2:35 P	-	18	7.7	7.3	10.0	3	1	-	19	25	54
	28	2:50 P	-	18	7.5	6.9	9.9	3	2	-	17	25	56
	29	3:30 P	-	17	6.3	6.7	7.5	7	5	-	17	21	49
	30	11:45 A	-	16	6.6	6.5	8.2	2	3	-	-	22	52
Maximum				20	7.7	7.3	10.0	7	5	-	19	33	59
Minimum				16	6.3	5.8	7.3	0	1	-	7	20	48
Average			78 (est)	18	6.9	6.7	8.7	2	2	-	14	24	53

* Sample taken on Mansfield Rd. August 26th through August 30th.

APPENDIX A

DATE 1963								As mg/l of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
							MYC-23 CASSELMAN RIVER NEAR CONFLUENCE, PA. AT HWY. 53 BRIDGE (RM 15.6-63.6-1.0)						
ug.	19	2:35 P	22	23	-	3.5	8.6	64	46	14	-	269	590
	20	1:20 P	48	22	-	4.0	8.5	40	37	8	-	216	490
	21	2:15 P	106	23	-	4.4	8.3	50	22	0	1	176	410
	22	2:00 P	108	24	-	4.2	8.2	24	19	4	-	182	420
	23	11:30 A	96	22	-	4.2	8.7	39	25	3	-	208	470
	26	3:10 P	33	23	4.2	4.2	8.8	20	16	2	-	155	375
	27	12:45 P	25	21	-	4.1	8.9	20	16	1	-	153	365
	28	11:40 A	24	21	4.6	4.2	8.8	32	15	1	-	163	370
	29	10:40 A	29	21	4.8	4.5	8.4	23	16	0	1	163	370
	30	1:05 P	68	23	5.0	4.4	8.7	22	15	0	1	168	377
Maximum				24	5.0	4.5	8.9	64	46	14	1	269	590
Minimum				21	4.2	3.5	8.2	20	15	0	0	153	365
Average			55	22	4.7	4.2	8.6	34	23	3	0	185	424

APPENDIX A

DATE 1963					pH			As mg/l of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
							MYC-24 CASSELMAN RIVER NEAR GRANTSVILLE, MD. AT RIVER RD. BRIDGE (RM 15.6-63.6-40.5)						
Aug.	13	-	-	21	-	-	3.0	-	-	-	-	92	234
	14	4:30 P	-	18	-	-	7.0	-	-	-	-	97	213
	15	2:15 P	-	20	-	-	3.7	-	-	-	-	85	187
	16	2:10 P	-	24	-	6.2	5.8	0	5	-	21	64	147
	19	3:15 P	-	24	-	6.2	8.0	0	2	-	15	79	182
	20	1:55 P	-	20	-	6.2	7.1	Tr.	1	-	14	92	202
	21	3:00 P	-	22	-	5.8	6.7	3	2	-	15	88	195
	22	2:30 P	-	23	-	5.9	6.4	4	2	-	10	53	124
	23	10:55 A	-	19	-	6.0	4.3	1	18	-	12	74	175
	26	4:00 P	-	25	6.9	6.6	5.5	2	3	-	16	94	212
	27	12:15 P	-	20	-	6.4	6.9	2	6	-	15	96	215
	28	1:00 P	-	20	6.6	6.6	5.5	2	4	-	17	100	215
	29	9:40 A	-	19	6.3	6.5	2.9	5	8	-	22	96	235
	30	1:50 P	-	22	6.0	6.3	6.9	2	1	-	8	82	185
Maximum				25	6.9	6.6	7.1	4	18	-	22	100	235
Minimum				18	6.0	5.8	3.0	0	1	-	8	53	124
Average			13.5(est.)	21	6.5	6.2	5.7	2	5	-	15	85	194

APPENDIX A

DATE 1963		Sampling Time	Flow cfs	Temp. °C	pH		D.O. mg/1	As mg/1 of $CaCO_3$					CONDUCT.
								ACIDITY			ALK.	HARDNESS	
Mo.	Day				Field	Lab.		Hot to Phenoth.	Cold to Phenoth.	Cold to M. O.	to M.O.	EDTA	micro-mhos
							MYS-25 SNOWY CREEK NEAR CORINTH, W.VA. AT STATE LINE (RM 15.6-116.4-3.1)						
Aug.	13	12:45 P	-	18	-	-	7.5	-	-	-	-	49	123
	14	4:30 P	-	17	-	-	8.2	-	-	-	-	36	80
	15	5:00 P	-	16	-	-	9.4	-	-	-	-	38	93
	16	2:25 P	-	18	-	6.4	8.9	0	-	-	9	40	104
	21	2:30 P	-	20	-	6.6	8.2	2	4	-	18	36	84
	22	2:10 P	-	20	-	6.7	8.1	4	5	-	19	30	72
	23	10:45 A	-	18	-	6.7	8.1	3	4	-	11	34	80
	26	4:50 P	-	20	6.2	5.9	8.6	2	5	-	8	33	86
	27	3:00 P	-	20	6.8	5.8	9.0	3	6	-	4	42	100
	28	3:45 P	-	17	6.9	6.0	7.7	4	7	-	6	42	110
	29	2:30 P	-	17	6.5	6.8	7.2	18	9	-	22	43	100
	30	2:45 P	-	18	6.4	6.4	8.0	6	5	-	8	28	67
Maximum				20	6.9	6.8	9.0	18	9	-	22	49	123
Minimum				16	6.2	5.8	7.2	0	4	-	4	30	67
Average			36	18	6.6	6.4	8.3	4	6	-	12	38	92

APPENDIX A

DATE 1963		Sampling Time	Flow cfs	Temp. °C	pH		D.O. mg/1	As mg/1 of $CaCO_3$					
								ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day				Field	Lab.		Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
								MYS-26 SNOWY CREEK NEAR CRELLIN, MD. (RM 15.6-116.4-1.0)					
Aug.	20	5:45 P	-	14	-	6.7	-	1	4	-	22	48	114
	21	1:30 P	-	19	-	6.2	8.0	4	3	-	15	34	81
	22	1:20 P	-	20	-	6.0	8.0	2	2	-	12	36	84
	23	11:25 A	-	18	-	7.3	8.1	3	2	-	11	30	73
	26	3:50 P	-	19	6.4	6.6	8.5	2	1	-	28	35	90
	27	1:50 P	-	16	7.1	6.6	8.9	2	3	-	7	35	90
	28	2:15 P	-	17	7.5	5.2	8.4	2	4	-	6	36	92
	29	3:45 P	-	17	5.3	5.3	8.1	11	5	-	5	37	101
	30	12:00 N	-	18	6.5	6.4	8.2	5	2	-	9	27	62
Maximum				20	7.5	7.3	8.9	11	5	-	28	48	114
Minimum				14	5.3	5.2	8.0	1	1	-	5	27	62
Average			36	18	6.6	6.3	8.3	4	3	-	13	35	87

APPENDIX A

DATE 1963								As mg/l of $CaCO_3$					
					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
							MYSL-27 LAUREL RUN NEAR CRELLIN, MD. AT STATE LINE (RM 15.6-116.4-0.7-0.2)						
Aug.	13	-	-	-	-	-	-	-	-	-	-	128	790
	14	3:30 P	-	18	-	-	6.5	-	-	-	-	44	212
	15	4:30 P	-	19	-	-	6.7	-	-	-	-	57	330
	16	1:55 P	-	20	-	3.5	7.1	78	70	40	-	64	435
	20	5:00 P	-	-	-	3.8	-	30	22	8	-	32	150
	21	1:45 P	-	19	-	3.9	7.0	47	43	16	-	46	255
	22	1:30 P	-	20	-	3.4	6.6	61	57	29	-	58	330
	23	11:20 A	-	19	-	3.4	6.7	69	64	46	-	66	400
	26	4:10 P	-	21	4.0	3.0	7.0	96	81	49	-	84	500
	27	2:15 P	-	20	3.2	3.1	7.5	105	104	57	-	89	530
	28	2:30 P	-	20	3.1	3.1	7.3	121	110	54	-	102	615
	29	4:00 P	-	18	4.2	4.2	7.5	18	16	1	-	26	96
	30	12:15 P	-	17	4.3	4.0	7.5	27	23	6	-	29	137
Maximum				21	4.3	4.2	7.5	121	110	57	-	128	790
Minimum				17	3.1	3.0	6.5	18	16	1	-	26	96
Average			20	19	3.8	3.5	7.0	65	59	31	-	64	368

APPENDIX A

								As mg/l of $CaCO_3$					
DATE 1963					pH			ACIDITY			ALK.	HARDNESS	CONDUCT.
Mo.	Day	Sampling Time	Flow cfs	Temp. °C	Field	Lab.	D.O. mg/l	Hot to Phenoth.	Cold to Phenoth.	Cold to M.O.	to M.O.	EDTA	micro-mhos
MTU-29 TURTLE CREEK IN TRAFFORD, PA. AT STEWART ST. BRIDGE (RM 11.5-7.0)													
Aug.	20	11:30 A	-	19	-	3.4	8.1	72	69	33	-	540	1650
	21	4:55 P	-	24	-	4.0	-	58	52	9	-	500	1510
	22	3:20 P	-	24	-	3.5	7.6	72	72	12	-	540	1620
	23	12:00 N	-	22	-	3.5	7.9	86	73	31	-	537	1640
	26	1:50 P	-	21	-	3.3	8.3	76	73	35	-	531	1680
	27	1:35 P	-	22	3.9	3.2	8.3	104	73	37	-	562	1725
	28	8:15 A	-	16	3.5	3.2	8.5	100	88	42	-	541	1700
	29	1:15 P	-	24	3.6	3.4	9.0	73	71	-	-	523	1620
	30	1:20 P	-	22	4.0	3.6	8.8	40	32	-	-	431	1350
Maximum				24	4.0	4.0	9.0	104	88	42	-	541	1725
Minimum				16	3.5	3.2	7.6	40	32	9	-	431	1350
Average				22	3.8	3.5	8.3	76	67	28	-	523	1610

APPENDIX B

INDIVIDUAL BIOLOGICAL FINDINGS

APPENDIX B

Bottom Organism Data - 1963

River Mile	Bottom Organisms Per Square Foot									Number of Kinds
	Midge	Sludgeworms	Caddisfly	Alderfly	Mayfly	Dragonfly	Stonefly	Misc.	Total	
MY- 15.6-44.4 Connellsville, Pa.	9	5	1	1	3	-	-	5	30	6
MY- 15.6-40.8	-	-	114	-	5	-	-	2	123	3
MY- 15.6-12.4	X	-	-	-	-	-	-	-	-	1 *
CASSELMAN RIVER										
MYC-15.6-63.6-40.5	1224	-	653	-	-	-	-	54	1931	8
MYC-15.6-63.6-36.6 State Line										
MYC-15.6-63.6-34.4	-	-	120	-	8	-	-	16	144	5
MYC-15.6-63.6-1.0	-	-	-	-	-	-	-	-	0	0

* Qualitative sample only.

APPENDIX B

Bottom Organism Data - 1963

River Mile	Bottom Organisms Per Square Foot									Number of Kinds
	Midge	Sludgeworms	Caddisfly	Alderfly	Mayfly	Dragonfly	Stonefly	Misc.	Total	
WEST FORK AND MONONGAHELA RIVER										
MW-128.7-66.0 Weston, W. Va.										
MW-128.7-55.0	13	-	47	-	8	-	-	24	92	12
MW-128.7-42.4	9	4	28	-	-	-	-	-	41	5
MW-128.7-20.0	18	9	-	-	-	-	-	-	27	3
MW-128.7- 4.4	8	1	-	7	-	-	-	-	16	4
MW-128.7- 0.2	58	-	-	2	-	-	-	-	60	2
MT-128.73 Tygart River										
M- 126.0	9	255	-	-	-	-	-	-	264	2
MB-125.4 Buffalo Creek										
MB-125.4-3.6	98	-	85	1	7	-	-	36	227	10
MB-125.4-2.5	20	16	-	1	2	-	-	10	49	11

APPENDIX B

Bottom Organism Data - 1963

River Mile	Bottom Organisms Per Square Foot									Number of Kinds
	Midge	Sludgeworms	Caddisfly	Alderfly	Mayfly	Dragonfly	Stonefly	Misc.	Totals	
M- 104.5	1	1	-	10	-	-	-	-	12	3
M- 94.2	5	29	-	1	-	2	-	-	37	4
M- 91.2 State Line										
M- 90.5	22	1	21	-	-	-	-	-	44	4
MC-89.4 Cheat River										
MD-87.1 Dunkard Creek										
MD-87.1-1.7	1181	-	-	2	-	-	-	-	1183	3
M- 85.8	37	1	1	1	-	-	-	-	40	4
M- 63.6	36	5	-	4	-	-	-	-	45	4
M- 44.0	21	12	-	-	-	1	-	-	34	3
M- 42.0 Charleroi, Pa.										
M- 15.6 Youghiogheny River										

APPENDIX B

Bottom Organism Data - 1963

River Mile	Bottom Organisms Per Square Foot									Number of Kinds
	Midge	Sludgeworms	Caddisfly	Alderfly	Mayfly	Dragonfly	Stonefly	Misc.	Totals	
TYGART RIVER										
MT-128.7-36.6 Phillipi, W. Va.	107	10	39	10	-	-	-	5	171	7
MT-128.7-18.6 Grafton, W. Va.	-	8	-	-	-	-	-	-	8	1
MT-128.7- 4.4	2	4	-	-	-	-	-	-	6	3
M-127.1 Fairmont, W. Va.										
CHEAT RIVER										
MCS-89.4-72.0-0.1 Shavers Fork	4	-	10	-	6	1	2	8	31	13
MCB-89.4-72.0-0.2 Black Water River	-	-	-	-	-	-	-	-	0	0
MC -89.4-72.0 Parsons, W. Va.										
MC -89.4-61.9	-	-	-	-	-	-	-	-	0	0
MC -89.4-40.9 Rowlesburg, W. Va.	-	-	-	-	-	-	-	-	-	7*
MC -89.4-27.7 Albright, W. Va.	2	-	-	-	-	-	-	-	2	1
MC -89.4- 2.9	20	-	-	-	-	-	-	-	20	1
M -89.4 Point Marion, Pa.										

APPENDIX B

Bottom Organism Data - 1963

River Mile	Bottom Organisms Per Square Foot									Number of Kinds
	Midge	Sludgeworms	Caddisfly	Alderfly	Mayfly	Dragonfly	Stonefly	Misc.	Total	
YOUGHIOGHENY RIVER										
MY- 15.6-119.5	-	-	14	3	2	-	-	1	20	5
MYS-15.6-116.4-6.1 Hopemont, W.Va.	16	16	236	-	100	-	-	4	372	11
MYS-15.6-116.4-3.1	-	-	-	-	-	-	-	-	0	0
MYS-15.6-116.4-2.2 State Line										
MYS-15.6-116.4-1.0	5	-	3	1	2	-	-	-	11	4
MYSL-15.6-116.4-0.7-0.2	-	-	-	-	-	-	-	-	0	0
MY- 15.6-111.7 Oakland, Md.	37	2	5	-	-	-	-	-	44	5
MY- 15.6-84.6	4	1	53	2	31	-	4	3	98	15
MY- 15.6-78.6 State Line										
MY- 15.6-68.9	23	1	54	-	4	-	2	1	85	12
MY- 15.6-63.6 Casselman Cr.										
MY- 15.6-62.9	-	-	-	-	-	-	-	-	0	0

APPENDIX C

BACTERIOLOGICAL DATA

MONONGAHELA RIVER BASIN
Bacteriological Data

Station	River Mile	pH	No. of Samples	T. Coli per 100/ml	F. Strep per 100/ml		Calculated T.Coli MPN/100 ml 30% Flow
M-1	M- 41.4	4.2	5	2,200	2,100	Max.	43,000
				1,480	480	Avg.	
				760	6	Min.	
M-2B	M- 70.7	3.8	4	1,700	14	Max.	14,000
				837	4	Avg.	
				270	< 1	Min.	
M-3	M- 85.0	3.9	9	210	260	Max.	34,500
				120	60	Avg.	
				10	< 2	Min.	
M-4	M- 90.7	3.9	9	300	1,000	Max.	313,000
				150	150	Avg.	
				20	< 2	Min.	
M-5	M- 98.0	4.1	9	1,400	210	Max.	308,000
				540	60	Avg.	
				90	10	Min.	
M-6	M-124.6	5.8	5	500	1,400	Max.	298,000
				440	400	Avg.	
				380	50	Min.	
MD-7	MD-87.1-3.5	2.8	9	10	1,200	Max.	-
				3	150	Avg.	
				< 2	< 2	Min.	

MONONGAHELA RIVER BASIN
Bacteriological Data

Station	River Mile	pH	No. of Samples	T. Coli per 100/ml	F. Strep per 100/ml		Calculated T.Coli MPN/100 ml 30% Flow
MB- 8	MB-125.4-3.0	7.4	9	800,000	9,000	Max.	
				205,000	6,510	Avg.	-
				18,000	520	Min.	
MW- 9	MW-128.7-4.4	4.7	9	23,000	120,000	Max.	
				6,010	20,780	Avg.	520,000
				< 100	< 1	Min.	
MW-10	MW-128.7-20.0	3.3	5	10	39	Max.	
				5	10	Avg.	1,657,000
				< 100	< 1	Min.	
MW-11	MW-128.7-31.9	7.0	5	3,100	4,200	Max.	
				2,300	970	Avg.	18,000
				1,500	92	Min.	
MT-12	MT-128.7- 4.9	5.8	9	4,700	100,000	Max.	
				1,720	24,820	Avg.	-
				< 100	< 10	Min.	
MT-13	MT-128.7-18.6	5.7	5	130	860	Max.	
				60	180	Avg.	-
				< 100	3	Min.	
MC-14	MC- 89.4- 3.5	4.5	9	100	150	Max.	
				40	20	Avg.	-
				< 10	1	Min.	

APPENDIX C

MONONGAHELA RIVER BASIN
Bacteriological Data

Station	River Mile	pH	No. of Samples	T. Coli per 100/ml	F. Strep per 100/ml		Calculated T.Coli MPN/100 ml 30% Flow
MC-15	MC-89.4- 9.3	5.3	9	150	170	Max.	-
				90	40	Avg.	
				30	< 1	Min.	
MC-16	MC-89.4-27.7	6.6	9	20,000	230,000	Max.	-
				7,110	43,520	Avg.	
				150	< 10	Min.	
MC-17	MC-89.4-45.0	7.0	5	10,000	1,800	Max.	-
				6,750	440	Avg.	
				3,500	3	Min.	
MY-18	MY-15.6-12.4	5.6	5	180	< 10	Max.	-
				115	< 7	Avg.	
				50	< 1	Min.	
MY-19	MY-15.6-44.4	6.5	9	1,900	770	Max.	-
				680	200	Avg.	
				100	20	Min.	
MY-190	MY-15.6-58.7	6.8	4	6,200	2,100	Max.	-
				1,970	810	Avg.	
				180	78	Min.	
MY-20	MY-15.6-68.9	6.5	5	440	430	Max.	-
				420	110	Avg.	
				400	< 1	Min.	

MONONGAHELA RIVER BASIN
Bacteriological Data

Station	River Mile	pH	No. of Samples	T. Coli per 100/ml	F. Strep per 100/ml		Calculated T.Coli MPN/100 ml 30% Flow
MY- 21	MY- 15.6-76.6	6.8	9	9,000	90,000	Max.	-
				4,060	20,610	Avg.	
				370	< 1	Min.	
MY- 210	MY- 15.6-111.9	6.6	9	350,000	168,000	Max.	-
				88,670	34,530	Avg.	
				5,000	70	Min.	
MY- 22	MY- 15.6-119.5	7.0	9	47,000	55,000	Max.	-
				18,570	17,150	Avg.	
				2,800	49	Min.	
MYC-23	MYC-15.6-63.6-1.0	4.4	9	16,000	61,000	Max.	-
				3,220	71,030	Avg.	
				10	< 1	Min.	
MYC-24	MYC-15.6-63.6-40.5	6.7	9	190,000	300,000	Max.	-
				88,670	71,030	Avg.	
				50,000	40	Min.	
MYS-25	MYS-15.6-116.4-3.1	6.3	9	54,000	220,000	Max.	
				12,720	34,020	Avg.	
				< 10	< 1	Min.	
MYS-26	MYS-15.6-116.4-1.0	6.6	5	33,000	4,400	Max.	-
				17,550	1,500	Avg.	
				2,100	57	Min.	
MYSL-27	MYSL-15.6-116.4-0.7-0.2	3.6	9	1,400	9,000	Max.	-
				430	2,110	Avg.	
				40	< 1	Min.	

APPENDIX D

INDUSTRIES

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Meriden, W. Va.	Badger Coal Co.	Fords Run-Tygart R.	MT-128	Coal Washing	Inadequate*
Barrackville, W. Va.	Bethlehem Mines Corp.	Buffalo Creek	MB-127- 3	Coal Washing	-*
Idamay, W. Va.	Bethlehem Mines Corp.	Helena Run	M-128	Coal Washing	-*
Granville, W. Va.	Christopher Coal Co.	Monongahela R.	M-	Coal Washing	-*
Maidsville, W. Va.	Christopher Coal Co.	Monongahela R.	M- 98	Coal Washing	-*
Buckhannon, W. Va.	Bridge Run Coal Co.	Buckhannon R.	MTB-128-47-20	Coal Washing	-*
Dola, W. Va.	Clinchfield Coal Co. (No.1)	Ten Mile Cr.	MWT-128-19-1	Coal Washing	-*
Phillipi, W. Va.	Clinchfield Coal Co.	Elk Cr.	MWE-128-43-30	Coal Washing	-*
Dola, W. Va.	Clinchfield Coal Co. (No.3)	L. Ten Mile Cr.	MWT-128-19-1	Coal Washing	-*
Dola, W. Va.	Corhart Refractories	Buckhannon R.	MTB-128-47	Misc. Mfg.	-*
Morgantown, W. Va.	Deckers Creek Sand Co.	Deckers Cr.	M- 101	Misc. Mfg.	-*
Grant Town, W. Va.	Eastern Associated Coal Corp.	Paw Paw Cr.	MP-122-5	Coal Washing	-*
Dawmont, W. Va.	Galloway Land Co.	West Fork R.	MW-128	Coal Washing	-*
Hodgesville, W. Va.	Hackers Creek Coal Co.	Hackers Cr.	MWH-128-50-25	Coal Washing	-*

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Rachel, W. Va.	Joanne Coal Co.	Buffalo Cr.	MB-127	Coal Washing	Inadequate*
Clarksburg, W. Va.	McNichol, D.E.Pottery Co.	West Fork R.	MW-128-32	Misc. Mfg.	-*
Spelter, W. Va.	Mathiessen & Hegeler Zinc Co.	West Fork R.	MW-128-23	Misc. Mfg.	Inadequate*
Stringer, W. Va.	Mountaineer Coal Co.	Bingamon Cr.	MW-128	Coal Washing	-*
Owings, W. Va.	Mountaineer Coal Co.	Mudlick Run	MW-128	Coal Washing	-*
Jordan, W. Va.	Mountaineer Coal Co.	Monongahela R.	M-	Coal Washing	-*
Farmington, W. Va.	Mountaineer Coal Co.	Buffalo Cr.	MB-127- 8	Coal Washing	-*
Fairview, W. Ve.	Mountaineer Coal Co.	Sugar Run	MP-122-11	Coal Washing	-*
Hodgesville, W. Va.	Pecks Run Coal Co.	Pecks Run		Coal Washing	-*
Cascade, W. Va.	Preston County Coke Co.	Deckers Cr.	MD-101-12	Misc. Mfg.	-*
Dola, W. Va.	Robey Run Coal Co.	L. Ten Mile Cr.	MWT-128-19-1	Coal Washing	-*
Four States, W. Va.	Rochester & Pittsburgh Coal Company	Tevebaugh Cr.	MW-128	Coal Washing	-*
Irona, W. Va.	Chapel Coal Co.	Cheat R.	MC- 89-45	Coal Washing	-*
Gage, W. Va.	Gage Coal Co.	Buffalo Cr.	MB-127	Coal Washing	-*
Howesville, W. Va.	Kray Coal Co.	Three Forks Cr.	MTTF-128-18-10	Coal Washing	-*

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Lost Creek, W. Va.	Petitto Bros. Coal Co.	Lost Creek	MWL 128-40-4	Coal Washing	Settling
Clarksburg, W. Va.	Carnation Milk Co.	Limestone Run, West Fork R.	MW 128-30	Milk Prod.	Aeration,T.F.
Galloway, W. Va.	Simpson Creek Collieries	Simpson River	MW 128-23-18	Coal Washing	None
Salem, W. Va.	Compass Coal Co.	Ten Mile Creek	MWT 128-19-5	Coal Washing	Pond
Monongah, W. Va.	Consolidation Coal Co.	West Fork R.	MW 128-5	Coal Washing	Settling
Huttonsville, W. Va.	Carnation Milk Co. Rec.Sta.	Tygart R.	MT 128-101	Milk Prod.	None
Buckhannon, W. Va.	Reppert-Fairmont Coal Co.	Buckhannon R.	MTB 128-47-20	Coal Washing	Pond
Century, W. Va.	Bethlehem Mines Corp.	Buckhannon R.	MTB 128-47-10	Coal Washing	Pond
Fairmont, W. Va.	Reilly Tar & Chemical Corp.	Monongahela R.	M 127	Misc.	Oil & Tar Sep.
Fairmont, W. Va.	Sharon Steel Corp.	Monongahela R.	M 127	By-prod. Coke	Extractor
Farmington, W. Va.	Jamison Coal & Coke Co.	Buffalo Creek	MTB 127-8	Coal Washing	Sludge Thickener

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Rivesville, W. Va.	Monongahela Power Co.	Monongahela R.	M 125	Misc.Mfg.Ind.	Settling
Everettville, W. Va.	Consolidation Coal Co.	Indian Creek	MI 118-1	Coal Washing	Settling
Morgantown, W. Va.	Mathieson Chemical Co.	Decker Creek	MD 101-0.5	Chemicals	Settling
Morgantown, W. Va.	Sterling Faucet Co.	Decker Creek	MD 101-0.5	Non-ferrous Metals	Partially connected to City Sewer
Cassville, W. Va.	Christopher Coal Co.	Scotts Run	MS 99-5	Coal Washing	None
Maidsville, W. Va.	Rosedale Coal Co.	Monongahela R.	M 98	Coal Washing	Settling
Parsons, W. Va.	Armour Leather Co.	Black Fork, Cheat R.	MC 89-78	Tanning	Settling
Parsons, W. Va.	Dorman Mills	Cheat R.	MC 89-78	Textile Mill Prod.	None
Albright, W. Va.	Englehart Woolen Mill Co.	Cheat R.	MC 89-35	Textile Mill Prod.	Septic Tank
Albright, W. Va.	Monongahela Power Co.	Cheat R.	MC 89-35	Misc.Mfg.Ind.	Settling

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Point Marion, Pa.	L. J. House Convex Glass Co.	Monongahela R.	M- 89	Misc. Mfg.	Settling
Wayne Twp., Pa.	Peoples National Gas Co.	Dunkard Cr.	MD- 87-14	Misc. Mfg.	Complete
Bobtown, Pa.	Shannopin Coal Co.	Dunkard Cr.	MD- 87-6	Sanitary	Primary
Nemacolon, Pa.	Buckeye Coal Co.	Monongahela R.	M- 75	-	-*
W. Bethlehem Twp., Pa.	Bethlehem Mines Co.	Ten Mile Cr.	MTM-66-10	-	-*
N. Union Twp., Pa.	Malsbury Mfg. Co.	Redstone Cr.	MR- 55-16	Misc. Mfg.	Secondary
"	Hopwood Lumber Co.	"	"	Misc. Mfg.	Primary
"	Uniontown Indus.Enterpr.Co.	"	"	-	-*
"	Simpson Towel Co.	"	"	Misc. Mfg.	Primary
Dunbar Twp., Pa.	Liberty Powder Co.	"	MR- 55-13	Chemicals	Septic Tank
W. Pike Run Twp., Pa.	Crescent Mine	Pike Run	MP- 51-6	Mining	Primary
W. Pike Run Twp., Pa.	Clyde S. Robinson Dairy	Pike Run	MP- 51-6	Dairy	Secondary
Howell Sore, Pa.	Allied Chemical Co.	Monongahela R.	M- 51	Chemicals	Primary
Allenport, Pa.	Pittsburgh Steel Co.	"	M- 46	Metal Prod.	Primary
Charleroi, Pa.	Corning Glass Works	"	M- 41	Misc. Mfg.	Primary

APPENDIX D

MONONGAHELA RIVER BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Monessen, Pa.	American Chain & Cable Co.	Monongahela R.	M- 39	Pickling	None
Donora, Pa.	American Steel Wire Co.	Monongahela R.	M- 34	Metal Prod.	Primary
W. Bethlehem, Twp., Pa.	J. & L. Donahue	Ten Mile Cr.	MTM-66-10	-	-*
Jefferson, Pa.	Detroit Steel Prod. Co.	Ten Mile Cr.	MTM-66-6	-	-*
N. Bethlehem Twp., Pa.	J. & L. Steel Corp.	Ten Mile Cr.	MTM-66-5	-	Secondary
N. Bethlehem Twp., Pa.	Vesta Coal Co. #1	Ten Mile Cr.	MTM-66-5	-	Secondary
N. Bethlehem Twp., Pa.	Vesta Coal Co. #2	Ten Mile Cr.	MTM-66-5	-	Secondary
E. Bethlehem Twp., Pa.	Clyde #3	Ten Mile Cr.	MTM-66-3	-	-*
Center Twp., Pa.	Equitable Gas Co.	S.F.Ten Mile Cr.	MTM-66-2-22	Refinery	Settling
Jefferson Twp., Pa.	C.W.Acklin Sand Quarries	S.F.Ten Mile Cr.	MTM-66-2- 3	Mining	Secondary
Jefferson Twp., Pa.	West. Penn. Power	S.F.Ten Mile Cr.	MTM-66-2- 3	Misc. Mfg.	Primary
Jefferson Twp., Pa.	Clyde #2	S.F.Ten Mile Cr.	MTM-66-2- 3	-	-*
Luzerne Twp., Pa.	J. & L. Steel Corp.	Monongahela R.	M- 66	-	-*
Brownsville, Pa.	Park & Tilford Dist. Inc.	Monongahela R.	M- 56	Distillery	Primary
S. Union Twp., Pa.	French Dyers & Cleaners	Redstone Cr.	MR-55-18	Misc. Mfg.	None
N. Union Twp., Pa.	Texas Eastern Trans. Co.	Redstone Cr.	MR-55-16	-	-*

APPENDIX D

YOUGHIOGHENY RIVER SUB-BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Elk Lick Twp., Pa.	Amos J. Yoder Co.	Casselman R.	MYC-15-70-44	Slaughtering	Secondary
Brothers Valley Twp.,Pa.	Meadow Gold Dairies	Buffalo Cr.	MYCB-15-70-28-8	Milk Receiving	Regulated Discharge
Somerset, Pa.	The DeVilbiss Co.	Coxes Cr.	MYCC-15-70-22-9	Metal Prod.	Secondary
Somerset, Pa.	A. W. Francis Co.	Coxes Cr.	MYCC-15-70-22-9	Plating	Secondary
Somerset Twp., Pa.	Somerset Beef & Prov. Co.	Coxes Cr.	MYCC-15-70-22-7	Slaughtering	None
Somerset Twp., Pa.	Somerset Canning Corp.	Coxes Cr.	MYCC-15-70-22-7	Canning	Lagoons
Stewart Twp., Pa.	Union Fire Brick Co.	Meadow Run	MYM- 15-62	Industrial	Complete
Dunbar Twp., Pa.	Interstate Amiesite Co.	Dunbar Cr.	MYD- 15-44-3	Industrial	Complete
Dunbar Twp., Pa.	Koppers Co.	Youghiogheny R.	MY- 15-44	Chemicals	Lagoons
Connellsville, Pa.	B. & O. Railroad	Youghiogheny R.	MY- 15-42	Industrial	Secondary
Connellsville Twp., Pa.	A. Overholt & Co.	Youghiogheny R.	MY- 15-42	Industrial	Complete
Bullskin Twp., Pa.	West Penn. Power Co.	Mounts Cr.	MYM-15-42-5	Industrial	Secondary
Hempfield Twp., Pa. Carbon Area, S.T.P.	Alfery Co.	Jacks Run	MYSJ-15-17-17-8	Slaughtering	Septic Tank to Lagoon
Hempfield Twp., Pa. Carbon Area, S.T.P.	M. Lepidi & Sons	Jacks Run	MYSJ-15-17-17-8	Slaughtering	Secondary
Hempfield Twp., Pa. Carbon Area, S.T.P.	J. E. Wineman Slaughterhouse	Jacks Run	MYSJ-15-17-17-8	Slaughtering	None

APPENDIX D

YOUGHIOGHENY RIVER SUB-BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
Greensburg, Pa.	Goldberg Provision Co.	Jacks Run	MYSJ-15-17-17-6	Slaughtering	None
Greensburg, Pa.	Railway & Indus. Eng.	Jacks Run	MYSJ-15-17-17-6	Industrial	None
S. W. Greensburg, Pa.	Pittsburgh Plate Glass Co.	Jacks Run	MYSJ-15-17-17-6	Industrial	Secondary
S. W. Greensburg, Pa.	Mercalier Mfg. Co.	Jacks Run	MYSJ-15-17-17-6	Industrial	Primary
S. W. Greensburg, Pa.	Walworth Co.	Jacks Run	MYSJ-15-17-17-6	Industrial	Primary
Youngwood, Pa.	Robertshaw-Fulton Controls	Jacks Run	MYSJ-15-17-17-1	Plating - Pickling	Secondary
Sewickley Twp., Pa.	John Badanjck	Sewickley Cr.	MYS- 15-17-6	Slaughtering	None
Sewickley Twp., Pa.	Westinghouse	Sewickley Cr.	MYS- 15-17-6	Domestic	Primary
Mt. PleasantTwp., Pa.	F. L. Ferrari	Shupes Run	MYSS-15-27-15-3	Petroleum	Secondary
Mt. Pleasant Twp., Pa.	Will G. Keck	Shupes Run	MYSS-15-27-15-3	Food Products	Septic Tank
E. Huntington Twp., Pa.	Click Bros. Co.	Jacobs Cr.	MYJ- 15-27-12	Slaughtering	Septic Tank
E. Huntington Twp., Pa.	E. B. Hostofer Co.	Jacobs Cr.	MYJ- 15-27-12	Slaughtering	None
E. Huntington Twp., Pa.	Smelke Bros. Co.	Jacobs Cr.	MYJ- 15-27-12	Slaughtering	None

APPENDIX D

YOUGHIOGHENY RIVER SUB-BASIN INDUSTRIES

LOCATION	INDUSTRY	RECEIVING STREAM	RIVER MILE	TYPE INDUSTRY	TREATMENT PROVIDED
E. Huntington Twp., Pa.	Penn. Screw & Bolt Co.	Jacobs Creek	MYJ-15-27-12	Metal Prod.	Secondary
E. Huntington Twp., Pa.	Bryce Bros.	Jacobs Creek	MYJ-15-27-12	Industrial	None
Scottdale, Pa.	The Duraley Co.	Jacobs Creek	MYJ-15-27-11	Metal Prod.	None
Scottdale, Pa.	Ruth Lambert Supply Co.	Jacobs Creek	MYJ-15-27-11	Lumber	None
Smithton, Pa.	Jones Brewing Co.	Youghiogheny R.	MY- 15-24	Brewery	None
West Newton, Pa.	Fusee Co.	Youghiogheny R.	MY- 15-18	Industrial	Complete
Hempfield Twp., Pa. Carbon Area S.T.P.	Silvis Farms, Inc.	Jacks Run	MYSJ-15-17-17-8	Milk Receiving	Complete
Hempfield Twp., Pa. Carbon Area S.T.P.	Westmoreland Glass Co.	Jacks Run	MYSJ-15-17-17-8	Industrial	Complete

* Unknown